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A study to identify the most efficient and cost effective method for the General Leonard Wood Army Community Hospital outlying clinic pharmacies to manage inventory & requisition stock

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

A Graduate Research Project which analyzes present inventory management practices at four outlying Army Health Clinics using one full year of data, computations are performed under three other inventory models and the results compared with results obtained under the present system. The study concludes that the economic order quantity (EOQ) model out-performs the others by offering greater cost savings and better response to demands. The clinics can use the savings to justify the purchase of automation equipment. The clinics should continue to electronically transmit requisitions directly from Logistics Division. Supplies should also continue to be sent directly to the clinics rather than using the hospital pharmacy as an intermediary. *Keywords: inventory management; inventory analysis; inventory control; medical supplies; cost effectiveness; medical facilities; (4-7)*

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**A STUDY TO IDENTIFY
THE MOST EFFICIENT AND COST EFFECTIVE METHOD
FOR THE GENERAL LEONARD WOOD ARMY COMMUNITY HOSPITAL
OUTLYING CLINIC PHARMACIES
TO MANAGE INVENTORY AND REQUISITION STOCK**

**A Graduate Research Project
Submitted to the Faculty of Baylor
University in Partial Fulfillment of
the Requirements for the Degree
of
Master of Health Care Administration
by**

Major Michael E. Zauner, Jr., MSC

13 June 1988

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Although a Graduate Research Project results in each individual student receiving credit for the effort, it is really a group effort. I would like to take this opportunity to recognize the others in my "group" who made this project progress from a vague collection of thoughts to a completed paper.

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I especially want to thank my family for their unwavering support these past two years. It was my loving wife who had enough confidence in my abilities to persuade me to apply for the program in the first place. During the past two years, she always understood when perhaps I had to devote more time to my studies than to my family. She continually supported me and had faith in my abilities even when my faith in myself faltered. She also was of immeasurable assistance in performing word processing and data entry during both phases of the program.

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For all these people and for others who have touched my life these past two years, I extend my deepest appreciation. I am convinced that I could never have completed the course without them all.



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I. INTRODUCTION

The health care industry has recently been forced to control its costs as it delivers medical treatment to the people of the country. The civilian portion of the industry increasingly has reimbursement rates linked to the Diagnosis Related Groups (DRGs), while the government sector hospitals are feeling the impact of shrinking budgets. These reductions to the operating budget by external forces cause hospitals to look to their internal operations to lower costs and salvage the operating margin.

One way in which managers are seeking greater control over their costs is through inventory management. The literature that was researched, in preparing this paper, indicates that pharmacies are the focal point of the inventory management improvement effort simply because pharmacies represent the largest single medical supply cost center in a civilian institution. Military facilities can also look to the pharmacy for savings and can, in fact, expect even greater savings. A military hospital pharmacy has the expanded mission of the outpatient pharmacy, and, since it obtains its supplies from the Logistics Division, savings in the pharmacy can be reflected in further savings in Logistics Division. These situations are not

commonly found in the civilian environment but indicate a potential source of greater savings for the military.

Proper inventory management involves more than controlling the quantity of each item, and it also provides savings beyond the simple costs involved in the inventory. Time savings can be achieved through efficient inventory management and obsolescence losses can be reduced. Most importantly, responsiveness to demands is greatly enhanced when the inventory is properly managed.

By focusing on the pharmacies in outlying clinics, it is hoped that cost savings can occur and the clinics' abilities to accomplish the mission can be enhanced. Time savings are critical in such an environment, since the staff is small and personnel are often called upon to perform more than their counterparts in the hospital. Frequently, the pharmacist or his technicians assume the additional responsibility of pharmacy inventory management. The importance of proper inventory management in the outlying clinic is thus evident.

Conditions Which Prompted The Study.

During the didactic phase of the graduate program, I attempted to remain current in the field of logistics while pursuing my other studies. I noticed an increased emphasis in the literature being placed on inventory management. In fact, until recently, discussions on inventory management were found almost exclusively in operations research and materials management journals. Presently, pharmacy, nursing, and hospital

administration journals frequently contain such discussions. In the current environment, articles center on the need to better manage an inventory in order to lower costs.

I had hoped to utilize my additional readings once assigned again in the logistics area. When solicited for potential research project topics, the Army hospital designated as my residency site presented a problem concerning the outlying clinic pharmacies. Since the problem involved inventory management, I was afforded the opportunity to apply my logistics background to my residence year.

The research problem was presented by the General Leonard Wood Army Community Hospital (GLWACH) pharmacy. The pharmacy chief has been faced with increasing drug costs and new drugs rapidly entering the market, while the budget has become less capable of supporting the higher price tag. He saw the outlying clinic pharmacy operations as key elements in managing the total pharmaceutical inventory and budget. He also detected inconsistencies in management among the various clinics.

The clinic personnel also identified the need for improvements. The personnel at each of the clinics felt that they devoted too much time to inventory management without the benefit of training, felt that they were unable to adequately support the demands, and felt that the support they received from the hospital was insufficient. The most widespread complaint was that it took too long to receive supplies. Other complaints were that they felt they did not have enough input into decisions

concerning the formulary, and, that somehow, they felt the hospital could provide further help.

To improve on this situation, research needed to be accomplished which would first determine how the pharmacy inventories were managed. These methods could then be compared to "accepted" procedures found in the literature to identify potential improvements. Finally, a determination needs to be made on what needs to be done, and by whom, in order to improve the situation.

Problem Statement

The problem is to determine the most efficient and cost effective method for the GLWACH outlying clinic pharmacies to manage inventory and requisition stock.

Objectives

To provide an appropriate resolution of the problem, the following objectives must be met:

1. Determine the most appropriate inventory model to use.
2. Determine whether stock levels should be centrally managed by the hospital, decentrally managed by the individual clinics, or a combination of the two.
3. Determine the best source of supply for the clinics that will minimize costs and order-ship time.
4. If it is determined that the hospital pharmacy should be the source of supply, determine the best means of requisitioning and shipping supplies.

5. Determine the feasibility of providing automation support to reduce the time devoted to supply procedures.

Criteria

To determine whether or not objectives have been met, the following criteria will be used:

1. All inventory models will be evaluated using the standard supply performance measures of demand satisfaction, demand accommodation, percent of lines at zero balance, and inventory turnover ratio.
2. The same measures will be used, along with cost benefit analysis, to guide decisions pertaining to whether or not stocks should be centrally managed.
3. Standard supply performance measures and cost benefit analysis will be used to determine which source of supply to use.
4. Statistical difference of means tests will be performed to determine the optimal transportation mode using average OST for each mode as the variable of interest.
5. Cost benefit analysis will be used to determine the feasibility of providing automation support.
6. Since the standard supply performance measures represent aggregate means of the performance of individual lines, statistical difference of means tests will be performed to analyze the significance of changes.

7. Should the data be insufficient to utilize supply performance measures, surrogate measures will be devised using sound statistical methods.

Assumptions

In pursuing this research project, the following assumptions are made:

1. Sufficient reliable data exists to complete the project.
2. Surrogate measures can be devised to compensate for insufficient or inaccurate data without compromising the validity of the study.

Limitations

The following could limit the proposed research project:

1. The project must be completed within existing funding guidelines. Funding constraints may limit the solution implementation, at least in the interim, to manual procedures.
2. Automation support for statistical and inventory computations is needed for problem resolution. If such support is not available, the speed and accuracy of solutions will be lessened.
3. A lack of sufficient or accurate data may necessitate the use of other techniques to complete the study.

Literature Review

Manual supply procedures, such as those employed by the outlying clinics, can be a costly method of maintaining an inventory, even for a relatively small operation such as a clinic

pharmacy. As reported by Thomas F. Hughes, manual systems are also difficult to manage.¹ Personnel must be trained in the overall Army supply system, as well as inventory management techniques. The clinic pharmacy inventories are managed by pharmacy technicians who have not received the benefit of such training. Each activity was asked to provide a written description of inventory management procedures presently in use. After reviewing these documents, it was obvious that none of the activities utilize modern inventory management techniques. Establishing reorder points (ROP) and requisitioning objectives (RO) often requires the use of relatively complex formulae. Using these formulae not only require additional training, but human error is more likely due to their complexity. Errors in computing levels, like improper inventory management, can have serious cost implications.

Inventory Costs. As is true in most service-oriented businesses, the majority of costs associated with running a hospital are personnel related. This is true in virtually all cost centers of the hospital except for materiel handling areas such as the pharmacy.^{2,3} In their article, Cox and Gibson indicate that drug costs represent between 60 and 70 percent of a pharmacy's budget.⁴ May and Herrick reported identical percentages, while Ferkovic estimated the drug costs to be between 60 and 80 percent of the operating budget of the pharmacy.^{5,6} Regardless of which estimate is used, it is obvious that the pharmacy inventory is a significant budget item for the

pharmacy and the entire facility. While none of the available literature specifically addressed subordinate clinic pharmacies, similar cost relationships can be expected to exist. In his article, "Quantitative Measurement of Inventory Control", Noel indicates that hospitals which dispense drugs for outpatients and those that operate satellite pharmacies, maintain higher inventory levels and therefore a larger portion of the budget is required to sustain those levels.⁷

Since a pharmacy inventory is a major cost element, it logically follows that if savings can be made in this area, these savings can significantly affect a health care facility's cost of doing business. Noel supports this statement in the same article referred to earlier.⁸ As alluded to earlier, inventory models seek to tell management at what level to reorder (ROP) and how much to maintain (RO). In answering these questions, inventory models commonly used today consider the economics of maintaining an inventory. Specifically, these models enable the management to maintain inventory levels sufficient to meet the demand while minimizing the cost.^{9, 10}

There are several costs associated with inventory management. Total measurable costs are typically divided into three areas: purchase cost, holding (or carrying) cost, and order cost.^{11, 12} The purchase cost is simply the price placed on the item by the vendor. May and Herrick, in their article, claim that the purchase cost can potentially present the hospital with the greatest savings.¹³ In the military, however, hospitals must

purchase from the Department of Defense (DOD) wholesale system if available. For items not available through that system, the government is obligated to follow the rules of the Federal Acquisition Regulation (FAR). This publication generally binds the government to seek the lowest price, with some exceptions. Purchase cost is generally the most controllable of the costs. The other costs are often considered sunk costs over which management has little control. They are useful in determining the total costs incurred by the inventory management operation.

The holding cost is usually described as a percentage of the dollar value of the average inventory. May and Herrick claim that carrying costs are commonly estimated at 25 percent in a hospital setting.¹⁴ Noel, in his article, provides a hospital carrying cost estimate of between 25 and 30 percent.¹⁵ He also indicates that storage costs in a pharmacy run even higher due to such things as security considerations for controlled drugs and the expiration of stocks.¹⁶ Factors contained in holding costs for any inventory include facility costs, such as construction and shelving; overhead, such as utilities; salaries; and operating supplies, such as forms, paper and pencils.^{17,18,19} The Department of the Army (DA) sets holding costs at 40 percent of the average inventory for all items.²⁰

In his article, Noel estimated order costs to be between 25 to 40 dollars per order.²¹ Additionally, he estimated the marginal acquisition costs for a hospital pharmacy at six dollars per order.²² Included in these costs are those relating to

inventory management functions, placement of orders, and receipt activities.^{23,24} For all items of inventory, DA has set the order costs at 4.50 dollars per order.²⁵

There are other costs which can be considered in the total cost equation but usually are omitted because they are difficult to estimate.²⁶ One such cost is termed inventory shrinkage which represents the cost of losses due to pilferage.²⁷ Other costs include shortage costs and excess costs.^{28,29} Finally, there are costs which are impossible to measure. If a pharmacy is short of items, for example, the impact on the morale of pharmacy personnel and on the well-being of patients can hardly be quantified.³⁰

Inventory Models. The pharmacy must maintain adequate stocks and still be cost conscious. To do this requires the use of the right inventory model. Most economic inventory models attempt to find the lowest total cost which is universally accepted to be the point where order costs and holding costs are equal.^{31,32,33} Figure 1 illustrates the relationships of these costs. The most common of these models is the economic order quantity (EOQ) model. Tables 1 and 2 depict the variables and the computations respectively of this and all other models and performance measures to be utilized in this research. Another model gaining wide acceptance is the economic part period (EPP) model. Several other economically-based models are in use today. Increasingly, these models undergo modifications to adapt to changing situations such as escalating prices.^{34,35,36}

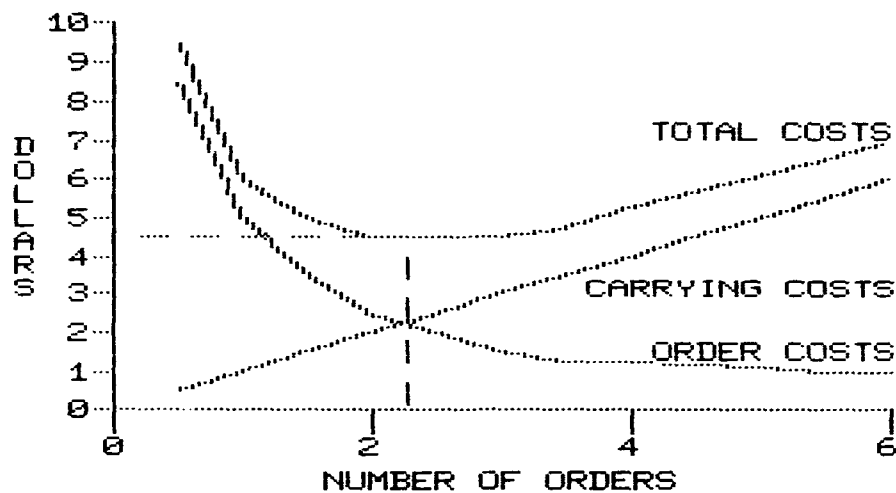


FIGURE 1: COST CURVES

Noneconomic models have continued to see widespread usage. They need to be considered in this study because of ease of use, standard prices used in DOD, and the need to satisfy demands because of patient care implications. These range from simple par level inventory management techniques to models requiring slightly more involved computations such as the days of supply model. Under par level management, the manager decides what level he wishes to maintain for each item. This is often done using historical usage figures, and the levels are set to last a particular period of time. When stock reaches a predetermined reorder point, usually set at a percentage of the total, sufficient stocks are ordered to bring the level "back to par". This method does not consider costs or fluctuations of the system. It also only requires simple algebra to determine levels. The days of supply method, as can be seen,

mathematically requires only simple algebra and does not consider the costs. Ease of computation is only one consideration in deciding upon the best inventory model to utilize in a particular

TABLE 1.
COMPONENTS OF INVENTORY MODELS AND PERFORMANCE MEASURES

Model	Variables
Economic Order Quantity (EOQ)	average annual demand rate (D), order cost (S), holding cost (I), item cost (C).
Economic Part Period (EPP)	order cost (S), holding cost (I), item cost (C).
Reorder Point (ROP)	average annual demand rate (D), safety level days (SLD), order-ship time days (OSTD). Note: If a decision has been made to not carry safety stock, then the ROP considers only D and OST, or, $ROP = OST$.
Total Cost (TC)	purchase cost (C_p), carrying cost (C_c), replenishment cost (C_r).
order-ship time (OST) quantity	average annual demand rate (D), order-ship time days (OSTD).
demand satisfaction	valid demands for stocked items 100% filled, valid demands for stocked items.
demand accommodation	number of demands for stocked items, total number of demands received.
percent of lines at zero balance	number of lines at zero balance, total number of lines stocked.
inventory turnover rate	annual purchases (in dollars), average annual inventory (in dollars).
days of supply (DOS)	operating level days (OLD), safety level days (SLD), order-ship time days (OSTD), quantity demanded in control period (QDCP).

organization.

Inventory Models and Demands. An inventory model must be effective at meeting the goals of the organization. One of these

considerations, minimizing the cost of inventory, has already been discussed. Unfortunately, a trade-off situation exists: minimizing inventory costs increases the risk that a supply organization will not be able to meet all demands. Basic

TABLE 2.
FORMULAE FOR INVENTORY MODELS AND PERFORMANCE MEASURES

Measure	Computation
EOQ	$\sqrt{\frac{2SD}{IC}}$
EPP	$\frac{S}{IC}$
ROP	$(D/360) \times (SLD + OSTD)$ or $(D/360) \times OSTD$
TC	$C_p + C_c + C_r$
OST quantity	$(D/360) \times OSTD$
* demand satisfaction	$\frac{\text{valid demands for stocked items 100\% filled}}{\text{valid demands for stocked items}}$
* demand accommodation	$\frac{\text{number of demands for stocked items}}{\text{total number of demands received}}$
* percent of lines at zero balance	$\frac{\text{number of lines at zero balance}}{\text{total number of stock lines}}$
* inventory turnover rate	$\frac{\text{annual purchases (in dollars)}}{\text{average annual inventory (in dollars)}}$
DOS	$[(OLD + SLD + OSTD)/360] \times QDCP$

* NOTE: These measures are typically presented as percentages in which case the results of the computations are multiplied by 100.

inventory models are based upon two assumptions which can exaggerate this trade-off and make the manager's job even more difficult. In practice, it is not valid to assume that demands

are constant, and that supplies are instantaneously received as the models require. Figure 2 is a graphic representation of the inventory cycle containing these two assumptions. The constant

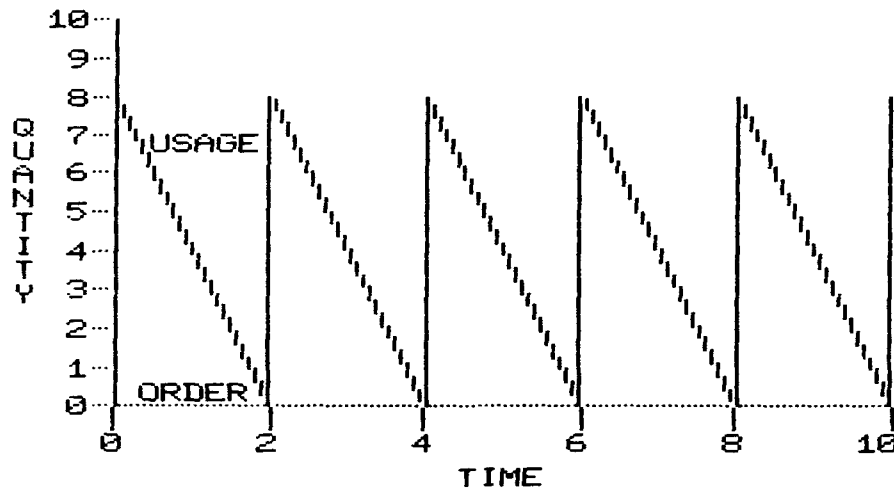


FIGURE 2: INVENTORY CYCLE ASSUMING CONSTANT DEMAND AND INSTANTANEOUS RECEIPT

demand is indicated by the identical usage slopes which create uniform distances between order points. The instantaneous receipt is represented by the vertical lines of the graph. In other words, no time elapses between when there are no stocks on hand and when stocks are completely replenished. There are two factors an inventory manager can include in inventory computations, which will enable demands to be met, while still holding costs down, and which will help overcome the limitations imposed on the model by the assumptions.

The first of these is a consideration of order-ship time (OST) or lead time. Simply stated, the OST factor represents the total expected demand for an item during the period of time required to procure it.³⁷ As a simplified example, suppose an

item is constantly demanded at a rate of two per day, and that it takes an average of ten days to procure that item. The amount of OST stock needed to cover demands during the procurement period is two times ten, or 20 items. It should be noted that the OST clock begins ticking when the decision has been made to place an order and ends when the item has been received and the receipt properly posted to the records. Figure 3 depicts the inventory cycle again, except the instantaneous receipt assumption has been relaxed. The dashed line in the figure becomes the reorder point

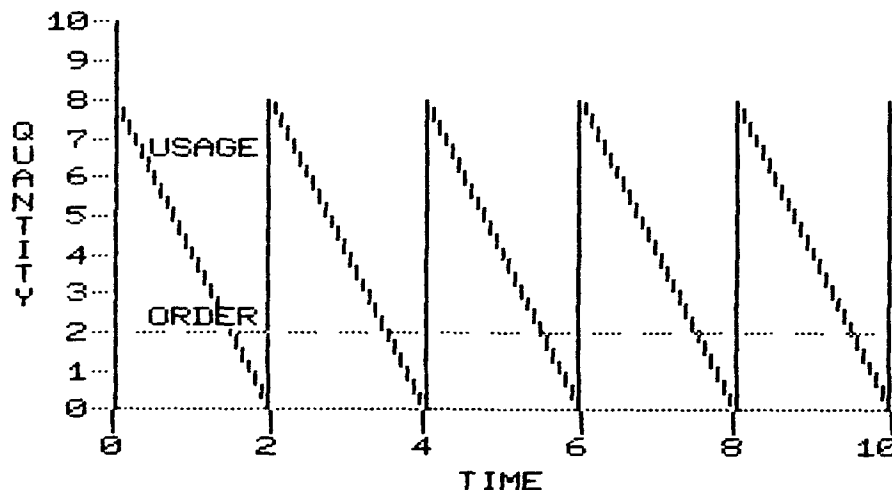


FIGURE 3: INVENTORY CYCLE ASSUMING ONLY CONSTANT DEMAND rather than when no stocks remain. The quantity of stock below the dashed line is the order-ship time, or lead time level. It should also be pointed out that demand is rarely constant, so, an organization may wish to include computations which consider the probabilities of a particular demand occurring.³⁰ Another method exists which is simpler to use, and is used most frequently to manage changing demands.

The second factor is termed the safety stock or safety level. As the name implies, the safety stock represents a quantity of items maintained to guard against a stockout caused by unexpected changes in the system.³⁹ The two most common changes which result in a stockout are an increase in OST and an increase in demand. Figure 4 illustrates the inventory cycle with all assumptions relaxed. The different demand rates are

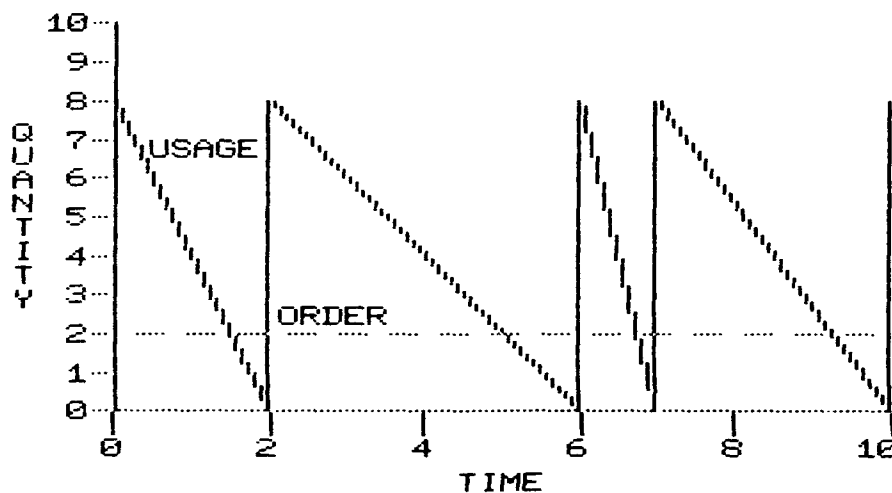


FIGURE 4: INVENTORY CYCLE RELAXING ALL ASSUMPTIONS

represented by the different slopes. Note how this affects the intervals between orders. Adding a safety level will raise the dashed line, and cause more frequent orders for fewer items to occur, if all else remains constant. Both the OST and safety levels are not without their costs.

Maintaining OST and safety levels necessarily increases the carrying cost of the inventory.⁴⁰ This is an obvious conclusion since carrying these levels increases the overall amount of stock maintained in inventory.⁴¹ The reorder point level is also

increased, which means an order is placed earlier when more stocks are on hand.⁴² Management must carefully consider these levels because of how optimal levels are computed. The equations result in high levels for low cost items, and zero levels for high cost items.⁴³ A decision must be made as to whether cost savings with safety levels, and OST levels of zero are worth the cost of a stockout.

The effectiveness of the various models are thus judged by their ability to reduce costs and to satisfy demands. Cost savings can be analyzed by comparing the total costs associated with each of the models. This can be done, prior to initiating a particular system, by making the inventory level computations under each model, and determining the costs. Relevant costs, for the most part, are based on estimates.⁴⁴ Unfortunately, evaluating a model's ability to satisfy demands is usually done in retrospect.

Evaluating the Effectiveness of Inventory Models. The simplest measure of this effectiveness is the percent of lines at zero balance. This measure shows a model's ability to reduce stockouts, but only considers the inventory position at one point in time, and is therefore subject to management manipulation. One performance indicator which indicates effectiveness over a period of time is called demand satisfaction. This measure is used by the military as well as the civilian industry.^{45,46} The results of this computation indicate the supply organization's ability to maintain adequate levels of stock over time. Another

useful indicator is termed demand accommodation. As the formula shows, this measure will indicate how well the supply system modifies the stockage list to adapt to changing demand patterns.⁴⁷

One final evaluation technique is the inventory turnover rate.⁴⁸ This rate is widely used in inventory management, regardless of the nature of the inventory. The formula is mathematically simple, but does provide valuable information.^{49,50} A rate of 12 or greater is generally preferred by hospital pharmacies in the civilian sector.⁵¹ If the rate is too low, the inventory levels are probably too high, and carrying costs are elevated.^{52,53} When dealing with pharmaceuticals, if the inventory is not issued, waste occurs because stocks expire before they are requested by the user. A high ratio indicates lower stock levels and increased stockouts.^{54,55}

Once a model is selected, cost and performance effectiveness can be further enhanced. As previously mentioned, the lower the unit cost of the item, the lower the inventory costs. Inventory managers should therefore seek the source of supply offering the lowest cost for the item, assuming comparability. Managers should also strive for standardization of items to avoid duplication and lower their costs.⁵⁶ Larger operations can also benefit from bulk quantity discounts. In fact, May and Herrick cite large volume buying as a significant advantage federal hospitals have over other facilities.⁵⁷ Managers can also select a transportation mode which lowers the order-ship time. Reducing

this time lowers storage costs by reducing lead time stock levels. Managers must be careful to ensure that increased transportation costs, usually associated with speedier delivery, do not exceed the storage cost savings.

As can be seen from the above discussion, this graduate research project can result in significant savings for the organization. Direct savings can be realized as well as indirect savings in manpower utilization and patient satisfaction. Since most military hospitals have outlying activities, it is possible that other facilities can benefit from this project.

Research Methodology

The research project was completed as follows:

1. An extensive literature research was conducted to form the theoretical framework for problem resolution.
2. After an orientation to pharmacy operations, a sample of outlying clinic pharmacies was selected to utilize for this project. The population consists of seven remote clinics assigned to the GLWACH. All seven operate a pharmacy. The sample size was determined by the size of the pharmacy operation at each location, because better and more usable results are obtained if sizes do not vary drastically. Four are similarly sized.
3. Demand data from the most recent one year period was gathered to compute demand rates.

4. Order-ship-time data for the most recent one year period was gathered. This data provided an overall average as well as an average by individual line.
5. Line items were separated into two categories: stocked by GLWACH and not stocked. Only stocked items were considered in the study.
6. The results of an earlier study were reviewed to determine whether or not the optimal means of transporting materiel from the GLWACH to the clinics was used.
7. The best inventory model to use was determined and tested with computer simulation using the OST obtained in number 4 above. Holding cost and order cost figures were those established by DA, and purchase costs were obtained from the Army Master Data File (AMDF).
8. The resulting data was reviewed to obtain solutions for the objectives and the research problem itself.

ENDNOTES

¹ Thomas F. Hughes, "Objectives of an Effective Inventory Control System," American Journal of Hospital Pharmacy 41 (1984): 2081.

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II. DISCUSSION

The General Leonard Wood Army Community Hospital was constructed as a 500 bed facility, but is currently staffed and authorized to operate 156 beds. The catchment area population of the hospital totals approximately 50,000 people. To support the medical treatment mission of the hospital, the Logistics Division stocks 8256 lines of medical supply items. Of these total lines, the pharmacy formulary represents approximately 1900 lines.

During Fiscal Year 1987 (FY87), the GLWACH had an average of 124.8 beds occupied daily. Also during FY87, there were 344,365 pharmacy procedures performed and a total of 386,742 clinic visits. The pharmacy consumed 2,429,000 dollars of the total hospital FY87 budget of 18,498,900 dollars. Table 3 presents similar background data on budgets and transactions for all facilities under consideration in this study.

Selection of a Sample of Clinics.

The GLWACH operates clinics in seven geographical areas remote from Fort Leonard Wood. Each of these locations operate an occupational health clinic, but only four operate an Army Health Clinic. Since the health clinics were the original focus of this study, only those four facilities were used. Moreover, the four health clinics conducted a similar volume of pharmacy

supply business in FY87. This volume was far greater than the occupational health clinics, and this greater volume can result

TABLE 3.
BUDGET AND TRANSACTION COMPARISON DATA

	Activity				
	GLWACH	Ft. Sheridan	Selfridge	Rock Island	St. Louis
Total Expenses	\$18,499	\$1,193	\$838	\$745	\$1,112
Total Supply Expenses	\$5,493	\$282	\$379	\$216	\$458
Total Pharm Expenses	\$2,429	\$190	\$333	\$185	\$414
Total Stock Expenses	Not Available	\$181	\$312	\$171	\$361
Prescriptions Filled	344	35	43	24	53
* Stock Transactions	Not Available	1921	2415	2546	2952

* NOTE: All entries are in 1000s, except where there is an asterisk indicating actual values are posted.

in more substantial savings through improved inventory management practices. Table 3 depicts the volume of business at each of the four clinics in terms of number of prescriptions filled and dollar value of expenditures in FY87.

The clinics are located at: St. Louis, Missouri; Rock Island Arsenal, Illinois; Fort Sheridan, Illinois; and Selfridge Air National Guard Base, Michigan. Each of these locations, with the exception of Fort Sheridan, are quite distant from a larger

military health care facility. Due to the remote locations, beneficiaries must often obtain more definitive treatment in the civilian community, but they have their prescriptions filled at the Army Health Clinic. As such, the pharmacy expenditures are larger than one would expect based upon the catchment area population and level of care.

All four clinics requisition stock directly from GLWACH Logistics Division, and can maintain inventories of only those items contained in the formulary. The preparation of the formulary, and the provision of technical expertise, are the only relationships that exist between the GLWACH pharmacy and the clinics. The clinics electronically transmit requisitions to Logistics Division. The clinics utilize modems to communicate with the mainframe computer at the hospital, and this process utilizes software contained on the mainframe. As such, when a transaction is entered, it is deposited in a file on the mainframe. These similarities, among the various clinics, led to the decision to include all the health clinics in the study, and a more extensive data collection effort was thus initiated.

The Data Collection Process

At the end of FY87, the decision was made on which clinics would comprise the sample. A decision was also made, at that time, to include the data for that entire fiscal year. Using a shorter period of time would possibly not present an accurate picture of demands. If, for example, only the data for summer months were included, the demand may be lower than the average

because of a lower incidence of illnesses or a greater personnel turnover during these months. The other advantage to using an entire fiscal year is that the standard prices for Army inventory items change only at the end of the year. Using a period of time that spans two fiscal years would mean additional computations to account for price changes and would not relate as nicely to budget figures.

I telephonically notified the pharmacy activities in each of the sample clinics to inform them of the research project, its potential benefits, and its data requirements. The following items were requested:

1. A copy of the FY87 document register.
2. A copy of stock record cards for all stocked items.
3. A description of present inventory management procedures to include formula(s) used in computing the RO and ROP.
4. A description of any problems being experienced.

Over the next few months, the requested data began to arrive. It became immediately obvious that I would require automation to perform the computations. Each of the clinics had in excess of 2000 supply transactions in FY87.

I utilized "Appleworks" on my home computer since it is an integrated package consisting of word processor, spreadsheet and data base management system. Such a system enabled me to easily and rapidly transfer information between the various segments of the software package. I also have several enhancement packages

such as graphics, which work in conjunction with Appleworks, so it seemed to be the most advantageous software to use.

Establishing Files and Data Entry

The data base management system within the integrated package was used as a vehicle to facilitate data entry, to provide basic computations, and to sequentially arrange records. One file for each clinic was prepared and included the following fields: National Stock Number (NSN), the Julian date the stock was requested, the Julian date the stock was received, the order-ship time (the difference between the entries in the previous two fields), the quantity ordered, and the unit price of the stock. It should be pointed out that only those items stocked by the GLWACH were entered in the file since nonstocked items are outside the scope of this project.

From this file, two basic outputs were provided. The first output contains all the fields as previously mentioned, and also reflects the extended price. The transactions are arranged in NSN sequence without eliminating duplicates and includes subtotals by NSN, and grand total figures for the order-ship time and extended price columns. Appendix B is a sample of this output. The output was directed only to the printer and was used as a means of validating the data entry process. The appendices containing sample outputs show only about ten percent of the transactions for one clinic. The appendices show data from the Saint Louis Army Health Clinic, and the data is sorted in descending sequence on the extended price field. This

arrangement helps illustrate how a supply operation can consume a large portion of its budget on purchasing a small portion of the inventory. After consulting with the faculty readers, and explaining the tremendous volume of data required to complete the project, they suggested that I only include the data found in the appendices. I have retained the six inch stack of output should anyone be interested in it.

The second output contains only the following fields: NSN, DST, quantity, unit price, extended price, and a field indicating the number of times the line was ordered during the fiscal year. Appendix C is a sample of this output, and it illustrates that the duplicates have been eliminated. It can also be seen that only the totals by NSN are produced. This output was directed both to the printer and to the disk for later access by the spreadsheet module.

The output which was directed to the disk was later read into the spreadsheet module. The basic spreadsheet, which was thus created, was used to perform computations under the various inventory models. To enable the output to fit on one page, one spreadsheet was used for each inventory model for each clinic.

An Analysis of the Inventory Models

The Present System. The model presently employed by the clinics is essentially a modified version of the days of supply model. The sample output at Appendix D represents the costs incurred under present conditions. It was used as a baseline to determine which of the other models could potentially lower the

costs or enhance responsiveness to demands. As can be seen, the present method does not seek to find the lowest value in the total cost curve, since the order costs and holding costs are not equal. Referring back to Figure 1, this model sets the vertical dashed line to the right of the equilibrium point. The total cost line is then intersected at a point which represents a higher cost. One could predict then, that the use of an economic inventory management model would result in lower costs.

The output also reveals the impact that order costs and holding costs can have on the overall budget. Using the standard cost figures for the Army, the clinics spent approximately 20 percent of total inventory costs on other than the price of the products. Table 4 presents summary cost and transaction figures for all the clinics using the present inventory system. For comparison purposes, cost data obtained from the literature were also used. Using these figures, 28 percent of the clinics' inventory costs would have been consumed by order costs and holding costs.

Using ABC Analysis. The sample output at Appendix E depicts a portion of a simple ABC analysis. Under the ABC method, the inventory should first be stratified as was done in Appendix E. By sorting the extended price field in descending sequence, those items where the most was spent on purchase costs rise to the top. The first ten percent of lines on the new list should represent 70 percent of the purchase costs (A items), the next 20 percent of the lines should contain 20 percent of purchase costs (B

TABLE 4.
COST AND TRANSACTION DATA UNDER PRESENT CONDITIONS

	Activity			
	Ft. Sheridan	Selfridge	Rock Island	St. Louis
Purchase Costs	\$180,575.98	\$311,526.11	\$170,708.47	\$361,462.82
Holding Costs	\$36,115.20	\$62,305.22	\$34,141.69	\$72,292.56
Order Costs	\$8,644.50	\$10,867.50	\$11,457.00	\$13,284.00
Total Costs	\$225,335.68	\$384,698.83	\$216,307.16	\$447,039.38
Average OST	11.03 days	9.51 days	8.33 days	10.2 days
Number of Orders	1921	2415	2546	2952

items), and the remaining 70 percent of the list should include ten percent of purchase costs.^{1,2,3} More intense management of A items can potentially return greater savings, and intensive management of this small number of lines should not significantly increase the workload.⁴

ABC analysis is not an inventory model, but it can be a flexible tool for the manager to use. The analysis simply identifies those lines that, in theory at least, can reward the manager's intensive management with the greatest savings. The manager is free to define what he will do to increase the intensity of his management efforts. In the present study, for example, the manager may continue with the present inventory

model except for the A category items. These may deserve management under an economic inventory model.

None of the clinics maintain a perpetual inventory which is the optimum method. A physical inventory is, therefore, the only way the clinics can determine the status of the stocks. Another alternative, then, is to perform the physical inventory more frequently on A items.⁵ Perhaps managing only A items, as a perpetual inventory, is a viable option.⁶

For this study, ABC analysis was done based upon financial considerations alone. The manager may want to rearrange inventory lines, and define the groups by criticality to the patient. The most critical items would become the A item group and be managed more intensively.⁷ This is outside the scope of the present study, but is offered as an option.

Economic Order Quantity (EOQ) Model. Using the actual transaction history from the past fiscal year, the calculations required under the EOQ model were made. A sample of the resulting output and additional EOQ formulae are at Appendix F. One area, which is immediately noticeable, is that the holding costs and order costs are equal for each item. As a result, the total inventory costs are also significantly lower than those occurring under the existing method. All clinics could realize significant savings by simply utilizing this method. Table 5 shows summary cost and transaction results for all the clinics after making the computations with the EOQ model. The comparison figures for this and all other models refer to the present

TABLE 5.
COST AND TRANSACTION DATA USING EOQ

	Activity			
	Ft. Sheridan	Selfridge	Rock Island	St. Louis
Number of Orders	1289	1633	1212	1961
Holding Costs	\$5,801.19	\$7,349.26	\$5,453.67	\$8,825.07
Order Costs	\$5,801.19	\$7,349.26	\$5,453.67	\$8,825.07
Total Costs	\$192,178.36	\$326,224.63	\$181,615.81	\$379,112.97
Order Number Difference	632 Fewer	782 Fewer	1334 Fewer	991 Fewer
Total Cost Difference	\$33,157.32 Less	\$58,474.20 Less	\$34,691.35 Less	\$67,926.41 Less

system. The computations under EOQ are more complex and more time consuming than the present method however.

Another potential problem with the EOQ model is that it may be more economically attractive to order in excess of a one year supply of the item. The amount of expired potency dated stock would likely increase. Without researching the shelf life for each line, I evaluated the impact on cost savings if I assumed an order quantity greater than nine months to be unacceptable. I sorted the records on the number of days of supply (Nd) field in ascending sequence. Those records where Nd was greater than 270 days had the holding costs and order costs recomputed under the present system. The others remained under the EOQ model. The

resulting combination approach still netted a savings of 188,902.02 dollars as compared with total savings of 194,249.28 dollars using all EOQ. Table 6 reports the results of this modified approach. One caution in ordering less than the quantity recommended by the EOQ model is that larger total cost increases occur under those circumstances.⁹

TABLE 6.
RESULTS OF MODIFIED EOQ APPROACHES

	Activity			
	Ft. Sheridan	Selfridge	Rock Island	St. Louis
# of Lines Nd > 270	172	118	214	186
Modified Cost	\$193,351.70	\$327,065.80	\$183,801.60	\$380,259.70
Modified Savings	\$31,983.94	\$57,632.95	\$32,505.47	\$66,779.66
Total Costs w/Top 10% EOQ	\$202,267.90	\$344,071.30	\$192,121.00	\$398,233.10
Total Cost Difference	\$23,067.73	\$40,627.43	\$24,186.09	\$48,806.18

At the other extreme, the results of inventory models should not be smaller than the quantity demanded during the order-ship time period. Using the EOQ model, Nd should be greater than the computed historical average order-ship time. Although none of the individual Nd results in this study were smaller than the overall average order-ship time, the manager may decide to override the recommendations of the inventory model. He may

increase the reorder point only, which will increase the order frequency and decrease the order quantity. He may increase both the reorder point and the requisition objective which, will tend to level-off the order frequency and quantity, while keeping stock on hand during the reorder period.

The Economic Part Period Model. Appendix G depicts sample results obtained under the economic part period model. It is immediately obvious that holding costs, and order costs, are equal for each of the items. Because of this, the model would be expected to maintain inventory levels at the lowest point in the total cost curve. The total costs under this model are actually much higher than any other model evaluated, including the model under which the clinics presently operate. Table 7 illustrates the summary data under this model.

The reason for the discrepancy can be found upon closer examination of the principles of the model. The model will initially find a point where the holding and order costs are equal.^{9,10} This point is termed the economic part period, and describes the number of parts to be ordered in one period, or, it can also indicate the number of periods to order the part for.¹¹ In other words, a value of two part periods can mean two parts in one period or one part in two periods. To function properly, one must be able to reasonably predict the demand in future periods and analyze the incremental savings to determine how many part periods to be ordered.¹² What should then happen, is additional economic part period quantities are added to the order quantity,

TABLE 7.
COST AND TRANSACTION DATA USING EPP

	Activity			
	Ft. Sheridan	Selfridge	Rock Island	St. Louis
Number of Orders	16,051	27,691	15,174	32,130
Holding Costs	\$72,230.39	\$124,610.44	\$68,283.39	\$144,585.13
Order Costs	\$72,230.39	\$124,610.44	\$68,283.39	\$144,585.13
Total Costs	\$325,036.76	\$560,747.00	\$307,275.25	\$650,633.08
Order Number Difference	14,130 More	25,276 More	12,628 More	29,187 More
Total Cost Difference	\$99,701.08 More	\$176,048.17 More	\$90,968.09 More	\$203,593.70 More

as long as the additional carrying cost is less than the order cost incurred by placing that additional order separately.^{13, 14} The EPP model does fail to recognize the order cost savings realized by including another EPP quantity in the order.¹⁵ Insufficient data prevented such an examination of this model. Further, demands for medications are not easily predicted, since illnesses are randomly inflicted upon people.

The Days of Supply Model. Results of computations made using the days of supply model are at Appendix H. The most obvious column is the one which lists the order costs. The same figure is shown regardless of the item or its purchase cost. This is because figures from last year were used, along with a

strict interpretation of the model, and its application by the Army. The Army restricts pharmacies to 30 days of supply under this model. The model simply takes the demand history and creates equal 30 day portions. Each line is, therefore, ordered 12 times per year, and the order costs are thus equal. The ability of the model to adjust order quantities, by considering the desired number of days, also makes it adaptable to stocking items to comply with a desired turnover rate. In other words, a 30 day supply, theoretically, should yield a turnover rate of 12. Because of this property of the model, it is sometimes referred to as the target turnover model.¹⁶ Realistically, these costs would fluctuate since the demands are not constant. If demand

TABLE 8.
COST AND TRANSACTION DATA USING DOS

	Activity			
	Ft. Sheridan	Selfridge	Rock Island	St. Louis
Number of Orders	5592	5256	5736	6924
Holding Costs	\$48,172.06	\$160,835.04	\$85,749.31	\$189,771.56
Order Costs	\$25,164.00	\$23,652.00	\$25,812.00	\$31,158.00
Total Costs	\$253,912.04	\$496,013.15	\$282,269.78	\$582,392.38
Order Number Difference	3671 More	2841 More	3190 More	3972 More
Total Cost Difference	\$28,576.46 More	\$111,314.32 More	\$65,962.62 More	\$135,353.00 More

fluctuations were reflected in this study, then this model would make computations from a different baseline than the other models. One could speculate that the actual total costs would approach those reflected under the present system, since it is a modified version of the days of supply model. Table 8 displays summary data obtained under this model.

An Analysis of the Computations.

Cost Analysis. When reviewing total cost savings over the present method for each of the models, the EOQ model clearly will lower inventory costs in each clinic evaluated. Even after making the necessary adjustments to avoid excess stock, the EOQ model still results in significant savings. Some of these savings are from a reduction in holding costs, and other savings are from the lower order costs. The lower order costs can be explained quite simply. The EOQ model directs fewer orders to be made than any of the other models.

The reduction in the number of orders would be expected to raise holding costs. The data in this study, however, shows even more drastic reductions in the holding costs. The algebraic design of this model reveals how this can happen. A closer examination of the EOQ sample output reveals that the model also considers the purchase costs in providing the order quantity results. Generally, as the cost of the item increases, the order quantity decreases, and the order frequency increases. This is because holding costs are normally expressed as a percentage of the inventory. The larger the dollar value of the inventory

then, the greater the holding costs. The model will simultaneously lower the holding costs and raise the order costs until equality has been reached.

The consideration the model places on the purchase cost of the item has important implications for the supply manager. Appendix F helps illustrate this importance. The listing is the top ten percent of expenditures, or A items. The column headed Nd indicates that, because of the high unit price, a small amount will be ordered. The small order quantity also means the risk of expired stock should be low. The savings under EOQ, on only A items of 136,687.43 dollars, makes a combination approach worthy of consideration to lower costs without severely increasing the workload. Table 6 summarizes the savings.

Conversely, as the cost of the item decreases, the model attempts to increase the order quantity and decrease the frequency. When the purchase cost is low, so is the holding cost for each item. Additionally, the order cost can often be higher than the purchase price for a whole year of stock. Once again, the model seeks to reach an equilibrium state between the holding and order costs.

One other behavior of the model is worthy of comment. I mentioned earlier that ordering quantities less than what the model recommends results in greater total cost increases. The shape of the total cost curve at Figure 1 supports that statement as well. Figure 1 also reveals the other behavior. The total cost curve on either side of the equilibrium point is relatively

flat. This indicates that the manager can depart slightly from the EOQ order quantity, without seriously altering the total costs.¹⁷

The foregoing paragraphs on the behavior of the model are substantiated by the computations made in this study. An understanding of algebra and an analysis of the EOQ equation itself verifies that the results obtained in the study are consistent with the design of the model.

Performance Analysis. An inventory model which controls costs, but is unable to supply the demands, is not worth implementing in an organization, unless the organization is willing to assume the stockout costs. A medical organization can hardly afford the cost and often must assume higher inventory costs to avoid a stockout.

Standard Performance Measures. In this study, I originally intended to utilize the standard supply performance measures to test the effectiveness of each model. I found that I was unable to do that because insufficient data existed to compute past performance, and I, therefore, could not measure changes in performance. I had to devise a suitable surrogate measure to determine the performance capabilities of the various models. First, I had to determine which standard measure could ordinarily apply to the study.

Since only stocked items were eventually considered in the study, the demand accommodation measure is not appropriate for use. The percent of lines at zero balance is a discrete variable

because it represents the posture of the inventory at a single point in time. The data was not available to make this computation. The zero balance position directly affects the computation of demand satisfaction over the continuum of the period of interest. Demand satisfaction would provide the best indication of the model performance in this study. Unfortunately, data is also unavailable to make this computation.

Inventory Turnover Rate. The inventory turnover rate was computed only for the total inventory, rather than by individual line. This is the customary way to compute this rate and recognizes that a wide variance, often by desire, may necessarily occur among the lines. The potency period of the item may dictate a more rapid turnover, because of a lack of demand, but its criticality requires it to always be on hand. Computing inventory turnover on the entire inventory is also the only way to make a valid comparison with the "industry standard".

Using the actual data from the previous FY, the inventory turnover rate actually experienced by each clinic was computed. Inventory turnover rates were computed for each of the other models as well. The results of the computations are at Table 9. Clearly, the outlying clinics' inventory turnover rates are less than the norm described in the literature. Even the industry standard proposed in the literature may be rapidly moving upward, if trends in the state of Missouri are any indication. When visiting several hospitals as part of the residency rotation, I asked all the materials managers what their inventory turnover

TABLE 9.
INVENTORY TURNOVER RATES

	Activity			
	Ft. Sheridan	Selfridge	Rock Island	St. Louis
Present Turnover	6.01	7.9	8.55	7.83
EOQ Turnover	6.23	8.48	6.26	8.19
DOS Turnover	12	12	12	12
EPP Turnover	34.44	63.22	31.74	55.68

rate was and the consistent reply was that they like to turn over inventory every one to two weeks. The pharmacies in these facilities experienced weekly turnovers. In fact, the pharmacies I visited did not even manage their own inventory. A contract was initiated with a vendor. The vendor would come to the pharmacy two or three times a week to perform a physical inventory and restock the shelves.

The foregoing trends indicate that managers see an advantage to greater inventory turnover rates, even if it violates the principles of economic inventory models. In some cases, this may mean a willingness to accept higher order costs in exchange for lower holding costs. On the other hand, as automated inventory management systems increase, order costs would be expected to decrease. Because of this, a study of the algebraic nature of the economic inventory formulae reveals that a lower order cost

forces the computation results to demand more frequent ordering of a lesser amount of supply. Adopting the results of the formulae would thus also lower holding costs. The trend toward contracted management of inventory relieves the facility of all management costs, except for the amount paid to the contractor for that purpose. It also places the hospital in a relatively risk-free environment, as far as inventory management is concerned.

Government facilities, on the other hand, have regulatory restrictions placed upon them which control the source of supply and stockage levels, among other things. Although this tends to stifle innovation, readiness requirements and other reasons make the restrictions reasonable. Additionally, the depot system enables the government to exercise its substantial buying power. To routinely depart from centralized purchases would dilute this impressive consolidation of power. Although outside the scope of this study, the lower purchase prices obtained by depot-level buying, at least partially, offsets the mission-mandated increased costs associated with high stockage levels.

Surrogate Performance Measures. An analysis of the demand satisfaction equation does suggest a viable surrogate method to test the models. The demand satisfaction formula, retrospectively, measures how many requisitions for stocked items out of every hundred the supply organization filled from existing stocks. A prospective estimate of how many requisitions out of every hundred the supply activity can fill, using each of the

models, is best approximated by inserting probabilities into the equation. Such an analysis is mathematically sound as described above.

The first question to be answered is: How is the demand data distributed? The description of the Poisson distribution seems to also describe the nature of a demand history pattern. The Poisson distribution deals with discrete rather than continuous variables¹⁹. Actual demands are discrete, integer numbers. That is, each demand is an integer, since a fraction of a demand is not possible. The Poisson distribution requires variables to be independent¹⁹. Demands are independent since the probability of one demand occurring is not dependent upon the probability of another demand occurring. Initially then, the Poisson distribution seems to be the statistical tool needed for this study. I next tested the data to determine whether or not it did fit the distribution.

Daniel reported that the variance of a Poisson distributed set of data would tend to equal the mean.²⁰ I could not find a single data set which satisfied this "rule of thumb" test. I next applied the more definitive chi-square goodness-of-fit test to the data.²¹ Once again, the results obtained dramatically eliminated any possibility of the data being Poisson distributed. One possible reason is, that for each line of stock, a small number of transactions were available. Another reason is that the data used in this study depicts usage of supply at the clinic pharmacy level rather than actual demands from the patient level.

The pharmacy accounts for, stocks, and reorders an item, for example, a bottle containing 1000 aspirin tablets. As long as the number of bottles on hand meets the stockage level criteria, more is not ordered. When an order is placed, it is for a certain number of bottles. The true patient demand, on the other hand, is for the number of tablets prescribed by the physician. Literally hundreds of patient demands can occur before the pharmacy places a demand on the supply system. Unfortunately, no data exists to provide the number of tablets of each drug that was dispensed for each prescription.

A review of my operations research class notes revealed that the z statistic, as shown below, can be used to instill probabilities into inventory management models:

$$z = (\text{observed value} - \text{mean}) / \text{standard deviation}$$

Use of this equation requires the data to be normally or near normally distributed.²² The chi-square goodness-of-fit test can also be used to determine whether or not the data are normally distributed.²³ The data in this study failed this test as well, perhaps for the same reasons it failed the earlier tests. In spite of the failure of the data to conform to the required distribution patterns, I elected to use the z statistic method to evaluate the models. At least it provides a common computation method, and facilitates comparison of the results.

Using data from the previous year, the annual demands can be used and a probability chosen. Using the equation below, a stock

level can be computed which should satisfy demands (based upon average annual demands) the desired percent of the time:

$$\text{desired value} = \text{mean} + (1.64 \times \text{standard deviation})$$

In other words, it should answer the question: "How many units of this item must I keep on hand, in order to satisfy demands a certain percentage of the time, given the past demand history?"

The supply manager only needs to determine what he considers to be an acceptable level of performance.

The Army is fortunate enough to have performance standards uniformly established for all activities. It is this performance rate of 95 percent that was used to judge the relative performance of the various inventory models. Since this was designed as a surrogate measure for demand satisfaction, aggregate data, by clinic, was entered into the equation. Statistically, it probably would have been more proper to have done an analysis of each line. Additionally, if the purpose of the analysis had been to actually adjust levels, then each line would have had a separate consideration. The analysis was designed to be a substitute for demand satisfaction, and provide a means of comparing the clinics with each other. The average inventory levels for each line were used in the analysis. A small sample of 50 lines were analyzed, by transaction, to verify the use of this procedure and the ranking remained the same. Table 10 below depicts the results of the performance analysis.

None of the models will perform to the level required to satisfy the z statistic. This is primarily due to the fact that

TABLE 10.
RESULTS OF PERFORMANCE MEASURES

	Activity			
	Ft. Sheridan	Selfridge	Rock Island	St. Louis
Mean	6.93	8.54	4.08	7.82
Standard Dev	8.68	10.72	5.71	11.50
95% Goal	21.17	26.12	13.44	26.68
Present Model	9.17	11.81	5.44	11.05
EOQ Model	13.47	16.62	10.73	15.07
DOS Model	4.22	7.03	3.02	6.17
EPP Model	4.83	4.50	4.67	4.46

neither the order-ship time, nor the safety levels, were considered in formulating the results. The results do indicate that the EOQ model exceeds the performance of the other models.

Selection of the Optimum Inventory Model.

As suggested in the criteria for this study, the optimal model is that one which lowers the total costs without degrading the level of service provided to the customer. A more optimal solution could be achieved if the model lowered costs and enhanced the level of service.

The analysis of the results indicates the EOQ model presents the optimal conditions under which the outlying clinics can operate.

Automation Analysis.

The potential savings offered by the model providing optimal results have already been identified. Even further savings can be realized by automating inventory management. Automation will reduce the time devoted to inventory management. The time reduction should be obvious, simply by looking at the complexity of the formula and the number of lines the formula is to be used on. Even making the computations required under the present system can be done infinitely faster with a computer than they can be done manually. An in depth analysis of total savings, through automation, will not be performed in this paper. Deriving all savings, such as manhours, would possibly be a research project itself. A simple cost-benefit analysis, which relates equipment costs to savings, is provided in this section, however.

Although any microcomputer on the market today is capable of handling an inventory comparable in size to the clinic pharmacies, the Zenith system is used in this analysis. The Army presently has a central contract for these machines at presumably the lowest price. Regardless of the price, units are required to purchase hardware, using this contract, unless they can demonstrate it is incapable of satisfying their needs. A component listing with current contract prices is at Appendix I.

The standard break-even analysis formula, as depicted below, is used in this study:

$$\text{break-even} = \text{total fixed cost} / (\text{cost per transaction under present conditions} - \text{cost per transaction under EOQ})$$

I performed the analysis for each clinic to demonstrate that each facility can justify automation equipment. The optimal inventory model savings were used to justify the savings. The results of the analysis indicate that Fort Sheridan need process only 241 transactions, Selfridge 172, Rock Island 305 and Saint Louis 181 to justify the equipment purchase.

One further advantage to utilizing the microcomputer is lower telephone bills. Instead of entering requisitions while connected to the mainframe, requisitions can be placed in a disk file on the microcomputer. The whole file can then be transmitted to the mainframe.

Departures From the Graduate Research Project Proposal.

Unfortunately, I was unable to complete all that I had originally intended in this project. Some departures from the proposal have already been discussed. This section will discuss other differences, and the reasons for them. I have discussed these with my primary reader and many difficulties were, admittedly, because I set my sights too high when preparing the proposal.

I originally intended to analyze several modes of transportation using order-ship time as the variable of interest. I did not perform the analysis because one such study had already been completed within the past few years. The results of the

analysis have been implemented, and the selected modes of transportation have performed well, as indicated by the order-ship times. They are also the lowest cost alternatives. The Logistics Division now pulls stock for issue, packages it, and sends it out to the outlying clinics by United Parcel Service or The United States Postal Service. Stock is sent daily as materiel release orders are printed from the computer system, rather than waiting for a set size or weight of freight.

I also intended to compare the performance of requisitioning directly from Logistics Division with requisitioning from the GLWACH Pharmacy, as proposed by the pharmacy chief. When I began researching in the pharmacy, I soon discovered that requisitioning from the pharmacy was not feasible. The pharmacy does not possess the automation capability to process the approximately 10,000 transactions per year from the outlying clinics. The pharmacy is also staffed below its authorized personnel levels. In this isolated area, finding sufficient qualified personnel is very difficult. For example, the pharmacy has been short two pharmacists for about a year. To handle the added mission of supplying outlying clinics, the pharmacy would need additional personnel to manage and ship stock. Without the additional people, routing requisitions and supplies through the pharmacy would only increase the order-ship time and degrade the service.

ENDNOTES

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² Michael W. Noel, "Inventory Control: A Review for Hospital Pharmacists," Hospital Pharmacy Nov. 1978: 622.

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⁵ Cox and Gibson 68.

⁶ Cox and Gibson 68.

⁷ Cox and Gibson 68.

⁸ Thomas F. Hughes, "Objectives of an Effective Inventory Control System," American Journal of Hospital Pharmacy 41 (1984): 2083.

⁹ Lawrence R. LaForge, "MRP and the Part Period Algorithm," Journal of Purchasing and Materials Management Winter 1982: 31.

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¹² LaForge 24.

¹³ LaForge 24.

¹⁴ LaForge et al. 31.

¹⁵ LaForge 24.

¹⁶ Celeste Lindley and John Mackowiak, "Methods of Inventory Control," American Journal of Hospital Pharmacy 42 (1985): 125.

¹⁷ Paul C. Jordan and W. Lee Schwendig, "Toward a More Flexible Ordering Policy," Journal of Purchasing and Materials Management Fall 1985: 26.

¹⁸ Wayne W. Daniel, Biostatistics: A Foundation for Analysis in the Health Sciences (New York: John Wiley & Sons, 1983) 71.

19 Daniel 71.

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21 Daniel 348.

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23 Daniel 340.

III. CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

A method of analyzing individual inventory models was developed, and comparisons were made to identify one model which out-performed the others. As a first step, supply transaction data for one year was collected from each of four outlying clinic pharmacies. Only transactions for items that are stocked by the hospital were considered in the study. Each supply transaction had computations performed under each of the supply models to provide performance data to analyze.

The first comparative performance analysis was concerned with finding the model that would result in the lowest total costs. The purchase, order, and holding costs were the figures standard to the Army. The results of this analysis indicated that significant savings were possible if the EOQ model were employed. An ABC analysis was also performed to demonstrate that a small number of lines consume the greatest portion of inventory costs. If the EOQ model was used only on the approximately ten percent of the lines which cost the most, the substantial savings over the present system is still possible.

A comparative analysis was also performed to determine which model would best satisfy the demands. With the exception of inventory turnover rate, the standard performance measures could

not be performed to assess the models. A statistically sound surrogate measure was used instead. Using this method, the EOQ model, once again, proved to be the best model. It was not the best model when analyzed using inventory turnover, but it still would provide a higher rate than the present system.

After reviewing all the results, the EOQ model was determined to be the best overall model. It clearly will lower costs and improve the ability of the clinics to satisfy demands. The formulae utilized to calculate results under EOQ are considerably more complex. The complexity would indicate that calculations require more time and would possibly result in a greater number of errors.

Although it was originally my intention to analyze the transportation modes available, such an analysis was not performed. After reviewing the present system, I discovered that prior research had been conducted into shipping supplies to the outlying clinics. The research concluded that the system now employed was the lowest cost, provided speedy and reliable service, and provides flexibility. The present order-ship time is well within standards and enables supplies to be shipped without waiting for a full truckload. The prior research and demonstrated good service indicated that a need for further research was not needed.

It was determined that the clinics need to continue to requisition directly from Logistics Division. The pharmacy is not staffed or equipped to handle the additional workload. This

inability would force the pharmacy to simply pass the requisitions or somehow attempt to take pharmacy stocks, ship them, and restock. Either of these alternatives would add to the order-ship time and degrade the present service. The pharmacy can still control what the clinics are issued by incorporating formulary restrictions.

Optimally, the clinics can best implement the EOQ model by obtaining additional automation equipment. The cost-benefit analyses performed clearly indicate that the financial benefits greatly exceed the costs. Time savings through automation will also decrease the order-ship time which, ultimately, will provide further inventory cost savings. Regardless of the outcome of this analysis, the outlying clinics are all scheduled to receive the Zenith systems over the next two fiscal years. The systems initially are capable of processing inventory management software, in addition to programs for which the systems were originally intended. The software should be capable of making the necessary EOQ computations and formatting requisitions. The transaction file can then be transmitted through the modem, which will reduce communications costs from the present level.

Recommendations

The outlying clinics should adopt the EOQ model for making inventory management decisions, after first gaining approval from Headquarters, Health Services Command. In the current environment of limited fiscal and personnel resources, this model will conserve on both, as demonstrated in this study. Until

automation becomes available, the clinic pharmacies should manage only the A items using this model. The clinics should manage other items under the present system and continue to electronically transfer all requisitions directly to Logistics Division.

Once automation is available, the clinic pharmacies should obtain inventory management software which is capable of performing EOQ computations. The clinics can then manage all lines under this model with the exception of where the model directs an order so large that it will cause stock to expire. All requisitions should be electronically transmitted, as an entire file, using the new equipment.

APPENDIX A

DEFINITIONS

DEFINITIONS

ABC Analysis: A method of arranging items of inventory by total cost over a period of time. The purpose is to identify those items costing the most so they can receive more intensive management.

Army Master Data File: A microfiche document which contains a listing of, and pertinent information for, every supply item available within the Army supply system.

Chi-square Goodness of Fit Test: A statistical test which determines whether or not an observed sample distribution conforms to a theoretical distribution that is believed to describe the population from which the sample was obtained.

Days of Supply Model: A noneconomic model which expresses reorder quantities in terms of the number of days that quantity should satisfy demands.

Demand Accommodation: A measure of performance which indicates the percent of requests for stocked or nonstocked items immediately filled over a given period of time.

Demand Satisfaction: A measure of performance which indicates the percent of requests for stocked items immediately filled over a given period of time.

Economic Order Quantity (EOQ) Model: The most popular of the economic inventory models. It attempts to find the lowest total cost and recommend the corresponding quantity of items to order.

Economic Part Period (EPP) Model: An economic inventory model which attempts to find the lowest total cost and recommend an appropriate quantity of items to purchase. Unlike the EOQ model, this model requires the manager to predict the future demands. It is, therefore, better suited to the production environment.

Formulary: A listing of pharmaceuticals available for use within a particular hospital. Often, other information is included, such as, restrictions against using a drug in a particular part of the hospital and the pharmacology of the medications.

Federal Acquisition Regulation: The publication governing how all federal agencies will procure items of supply and equipment from civilian sources. It generally dictates that items will be obtained from the source offering the lowest price. It does, however, require priorities be given in certain instances to small businesses or minority-owned businesses.

Holding Cost: The cost incurred in maintaining an inventory. Included in this cost are: salaries for warehouse personnel, operating supplies, and facility costs. This cost is usually expressed as a percentage of the average inventory.

Inventory Turnover Rate: A measure of performance which indicates the frequency at which stocks are requisitioned during a given period of time.

Mean: A statistical measure of central tendency also referred to as the average.

Order Cost: Cost incurred in placing an order. Included in this cost are: salaries for inventory management and purchasing personnel, and operating supplies in those areas. This cost is usually expressed as a particular amount per order.

Order-Ship Time (Lead Time): The time required to obtain resupply of stock. The period of time begins when a decision has been made to obtain the item, and ends when the item has been received and the receipt posted to the records. A level of stock is typically maintained to satisfy demands during this period and is referred to as order-ship time stock or lead time stock.

Par Level Inventory Management: A simple method of inventory management which does not require complex calculations. It requires the requisitioning objective and reorder points to be established less frequently.

Percent of Lines at Zero Balances: A measure of performance which indicates the percentage of stocked lines that have no stocks on hand at a given point in time.

Poisson Distribution: A discrete, statistical distribution which describes a number of independent occurrences of events. The events are randomly distributed in time.

Potency Dated Items: An item which can serve its intended purpose only for a given length of time.

Purchase Cost: The actual price placed on an item by the vendor.

Reorder Point: A predetermined inventory level that signifies when new level computations and a reorder of supplies must occur.

Requisitioning Objective: The level of inventory which represents the maximum amount, to have on hand, to cover anticipated demands.

Safety Stock (Safety Level): An additional level of stock (or the raising of the reorder point) which is maintained to prevent a stockout should demands or order-ship time increase.

Standard Prices: Prices established by the Department of Defense depot system for items it manages. The price is established equal to the price paid to the vendor plus, additional surcharges for transportation and shrinkage. The prices are updated at the start of the fiscal year.

Standard Deviation: A statistical measure of dispersion which indicates how widely scattered about the mean a particular set of data is. It is the square root of the variance.

Stockout (Zero Balance): A condition which exists when no items remain for a particular line of stock.

Variances: A statistical measure of dispersion which indicates how widely scattered about the mean a particular set of data is.

Z Statistic: A statistic which describes the area under the standard normal curve.

APPENDIX B

SAMPLE OUTPUT FROM FILE CONTAINING RAW DATA
FROM DOCUMENT REGISTER

NSN	OJD	RJD	Ost	QTY	UP	EP
6505011607702	7132	7134	2	24	37.71	905.04
6505011607702	6307	6311	4	24	37.71	905.04
6505011607702	6321	6328	7	24	37.71	905.04
6505011607702	6330	6349	19	24	37.71	905.04
6505011607702	6357	7001	9	24	37.71	905.04
6505011607702	7008	7016	8	48	37.71	1810.08
6505011607702	7016	7026	10	60	37.71	2262.60
6505011607702	7063	7071	8	60	37.71	2262.60
6505011607702	7121	7131	10	24	37.71	905.04
6505011607702	7159	7167	8	36	37.71	1357.56
6505011607702	7170	7180	10	24	37.71	905.04
6505011607702	7187	7190	3	24	37.71	905.04
6505011607702	7208	7215	7	24	37.71	905.04
6505011607702	7225	7231	6	12	37.71	452.52
6505011607702	7231	7240	9	60	37.71	2262.60
6505011607702	7237	7246	9	24	37.71	905.04
6505011607702	7272	7288	16	48	37.71	1810.08
			145	564		21268.44
6505011456757	6321	6328	7	2	502.40	1004.80
6505011456757	7078	7084	6	1	502.40	502.40
6505011456757	6330	6349	19	1	502.40	502.40
6505011456757	6342	6352	10	2	502.40	1004.80
6505011456757	7027	7037	10	1	502.40	502.40
6505011456757	7041	7051	10	1	502.40	502.40
6505011456757	7049	7056	7	2	502.40	1004.80
6505011456757	7071	7077	6	2	502.40	1004.80
6505011456757	7120	7131	11	3	502.40	1507.20
6505011456757	7132	7134	2	3	502.40	1507.20
6505011456757	7170	7180	10	2	502.40	1004.80
6505011456757	7195	7203	8	3	502.40	1507.20
6505011456757	7225	7251	26	3	502.40	1507.20
6505011456757	7237	7251	14	2	502.40	1004.80
6505011456757	7248	7253	5	5	502.40	2512.00
6505011456757	7217	7251	34	4	502.40	2009.60
			185	37		18588.80
6505011197848	6289	6295	6	12	27.61	331.32
6505011197848	6307	6311	4	16	27.61	441.76
6505011197848	6310	6317	7	96	27.61	2650.56
6505011197848	6329	6349	20	72	27.61	1987.92
6505011197848	7027	7036	9	36	27.61	993.96
6505011197848	7049	7056	7	24	27.61	662.64
6505011197848	7100	7112	12	36	27.61	993.96
6505011197848	7132	7134	2	72	27.61	1987.92
6505011197848	7138	7144	6	24	27.61	662.64
6505011197848	7153	7177	24	36	27.61	993.96
6505011197848	7160	7180	20	48	27.61	1325.28
6505011197848	7178	7210	32	36	27.61	993.96
6505011197848	7225	7231	6	36	27.61	993.96

NSN	OJD	RJD	OST	QTY	UP	EP
6505011197848	7231	7240	9	36	27.61	993.96
6505011197848	7248	7253	5	36	27.61	993.96
			169	616		17007.76
6505011464174	6296	6304	8	16	32.17	514.72
6505011464174	6310	6317	7	36	32.17	1158.12
6505011464174	6329	6349	20	36	32.17	1158.12
6505011464174	7016	7026	10	36	32.17	1158.12
6505011464174	7063	7070	7	24	32.17	772.08
6505011464174	7132	7134	2	36	32.17	1158.12
6505011464174	7153	7177	24	24	32.17	772.08
6505011464174	7160	7180	20	24	32.17	772.08
6505011464174	7177	7191	14	24	32.17	772.08
6505011464174	7202	7215	13	24	32.17	772.08
6505011464174	7231	7240	9	36	32.17	1158.12
6505011464174	7248	7253	5	24	32.17	772.08
6505011464174	7261	7268	7	24	32.17	772.08
			146	364		11709.88
6505009010043	6289	6295	6	6	93.04	558.24
6505009010043	6307	6311	4	4	93.04	372.16
6505009010043	6321	6328	7	5	93.04	465.20
6505009010043	7008	7016	8	12	93.04	1116.48
6505009010043	7020	7028	8	12	93.04	1116.48
6505009010043	7049	7056	7	12	93.04	1116.48
6505009010043	7103	7112	9	12	93.04	1116.48
6505009010043	7121	7131	10	7	93.04	651.28
6505009010043	7138	7151	13	6	93.04	558.24
6505009010043	7170	7180	10	10	93.04	930.40
6505009010043	7177	7191	14	10	93.04	930.40
6505009010043	7225	7231	6	9	93.04	837.36
6505009010043	7237	7246	9	5	93.04	465.20
6505009010043	7251	7258	7	6	93.04	558.24
6505009010043	6342	6352	10	5	93.04	465.20
			128	121		11257.84
6505010503547	7001	7013	12	36	29.46	1060.56
6505010503547	6289	6301	12	12	29.46	353.52
6505010503547	6310	6317	7	24	29.46	707.04
6505010503547	6329	6349	20	36	29.46	1060.56
6505010503547	7027	7036	9	24	29.46	707.04
6505010503547	7049	7056	7	24	29.46	707.04
6505010503547	7071	7079	8	24	29.46	707.04
6505010503547	7120	7131	11	24	29.46	707.04
6505010503547	7131	7134	3	24	29.46	707.04
6505010503547	7157	7167	10	24	29.46	707.04
6505010503547	7195	7203	8	24	29.46	707.04
6505010503547	7202	7210	8	24	29.46	707.04
6505010503547	7237	7246	9	24	29.46	707.04
6505010503547	7267	7288	21	24	29.46	707.04
			145	348		10252.08

NSN	OJD	RJD	OST	QTY	UP	EP
6505011357373	7035	7056	21	12	27.73	332.76
6505011357373	6296	6304	8	24	27.73	665.52
6505011357373	6329	6349	20	24	27.73	665.52
6505011357373	6342	6352	10	24	27.73	665.52
6505011357373	7001	7013	12	48	27.73	1331.04
6505011357373	7055	7063	8	48	27.73	1331.04
6505011357373	7120	7131	11	36	27.73	998.28
6505011357373	7138	7144	6	24	27.73	665.52
6505011357373	7195	7203	8	24	27.73	665.52
6505011357373	7225	7231	6	24	27.73	665.52
6505011357373	7231	7240	9	24	27.73	665.52
6505011357373	7248	7253	5	24	27.73	665.52
			124	336		9317.28
6505012208416	7272	7288	16	12	35.79	429.48
6505012208416	6296	6304	8	12	35.79	429.48
6505012208416	6310	6317	7	12	35.79	429.48
6505012208416	6330	6349	19	36	35.79	1288.44
6505012208416	6342	6356	14	36	35.79	1288.44
6505012208416	7063	7071	8	24	35.79	858.96
6505012208416	7078	7084	6	24	35.79	858.96
6505012208416	7131	7134	3	48	35.79	1717.92
6505012208416	7202	7210	8	24	35.79	858.96
6505012208416	7251	7258	7	24	35.79	858.96
			96	252		9019.08
6505001050372	6358	7001	8	12	28.26	339.12
6505001050372	7146	7155	9	72	28.26	2034.72
6505001050372	7202	7210	8	72	28.26	2034.72
6505001050372	7216	7219	3	60	28.26	1695.60
6505001050372	7049	7056	7	60	28.26	1695.60
			35	276		7799.76
6505012149062	7216	7219	3	24	24.95	598.80
6505012149062	6309	6314	5	48	24.95	1197.60
6505012149062	6310	6317	7	48	24.95	1197.60
6505012149062	7016	7026	10	12	24.95	299.40
6505012149062	7035	7056	21	24	24.95	598.80
6505012149062	7049	7056	7	24	24.95	598.80
6505012149062	7100	7112	12	12	24.95	299.40
6505012149062	7120	7131	11	15	24.95	374.25
6505012149062	7132	7134	2	12	24.95	299.40
6505012149062	7159	7167	8	24	24.95	598.80
6505012149062	7187	7190	3	12	24.95	299.40
6505012149062	7225	7231	6	36	24.95	898.20
			95	291		7260.45
6505010723426	6289	6295	6	6	52.35	314.10
6505010723426	6307	6311	4	6	52.35	314.10
6505010723426	6342	6352	10	6	52.35	314.10

NSN	OJD	RJD	OST	QTY	UP	EP
6505010723426	7008	7016	8	8	52.35	418.80
6505010723426	7078	7090	12	10	52.35	523.50
6505010723426	7121	7131	10	10	52.35	523.50
6505010723426	7131	7134	3	12	52.35	628.20
6505010723426	7153	7177	24	12	52.35	628.20
6505010723426	7177	7191	14	12	52.35	628.20
6505010723426	7187	7190	3	12	52.35	628.20
6505010723426	7217	7222	5	12	52.35	628.20
6505010723426	7237	7246	9	12	52.35	628.20
6505010723426	7251	7258	7	16	52.35	837.60
			115	134		7014.90
6505011263842	6321	6328	7	24	22.23	533.52
6505011263842	6329	6349	20	36	22.23	800.28
6505011263842	6342	6352	10	36	22.23	800.28
6505011263842	7035	7056	21	12	22.23	266.76
6505011263842	7063	7070	7	48	22.23	1067.04
6505011263842	7071	7077	6	48	22.23	1067.04
6505011263842	7120	7134	14	36	22.23	800.28
6505011263842	7146	7155	9	24	22.23	533.52
6505011263842	7153	7177	24	24	22.23	533.52
			118	288		6402.24
6505010396321	6296	6304	8	10	50.10	501.00
6505010396321	6357	7001	9	10	50.10	501.00
6505010396321	7008	7016	8	12	50.10	601.20
6505010396321	7027	7037	10	8	50.10	400.80
6505010396321	7041	7051	10	6	50.10	300.60
6505010396321	7055	7061	6	6	50.10	300.60
6505010396321	7100	7113	13	12	50.10	601.20
6505010396321	7120	7131	11	6	50.10	300.60
6505010396321	7146	7155	9	6	50.10	300.60
6505010396321	7153	7177	24	6	50.10	300.60
6505010396321	7170	7180	10	12	50.10	601.20
6505010396321	7177	7191	14	6	50.10	300.60
6505010396321	7217	7223	6	12	50.10	601.20
6505010396321	7231	7240	9	6	50.10	300.60
6505010396321	7248	7253	5	8	50.10	400.80
			152	126		6312.60
6505010906797	6321	6328	7	24	11.19	268.56
6505010906797	6342	6352	10	72	11.19	805.68
6505010906797	6357	7001	9	72	11.19	805.68
6505010906797	7016	7026	10	24	11.19	268.56
6505010906797	7041	7051	10	48	11.19	537.12
6505010906797	7049	7056	7	72	11.19	805.68
6505010906797	7120	7131	11	48	11.19	537.12
6505010906797	7159	7167	8	36	11.19	402.84
6505010906797	7170	7180	10	36	11.19	402.84
6505010906797	7187	7190	3	36	11.19	402.84

NSN	OJD	RJD	OST	QTY	UP	EP
6505010906797	7216	7219	3	24	11.19	268.56
6505010906797	7225	7231	6	36	11.19	402.84
6505010906797	7261	7268	7	36	11.19	402.84
			101	564		6311.16
6505010402278	6289	6297	8	4	85.40	341.60
6505010402278	6310	6317	7	10	85.40	854.00
6505010402278	6342	6352	10	6	85.40	512.40
6505010402278	7008	7016	8	10	85.40	854.00
6505010402278	7049	7056	7	5	85.40	427.00
6505010402278	7100	7112	12	10	85.40	854.00
6505010402278	7153	7177	24	6	85.40	512.40
6505010402278	7170	7180	10	6	85.40	512.40
6505010402278	7217	7222	5	4	85.40	341.60
6505010402278	7248	7253	5	1	85.40	85.40
6505010402278	7177	7191	14	6	85.40	512.40
			110	68		5807.20
6505011403199	6281	6297	16	6	17.87	107.22
6505011403199	7264	7267	3	12	17.87	214.44
6505011403199	6267	6280	3	6	17.87	107.22
6505011403199	6308	6324	16	18	17.87	321.66
6505011403199	6322	6325	3	10	17.87	178.70
6505011403199	6332	6339	7	16	17.87	285.92
6505011403199	7005	7008	3	20	17.87	357.40
6505011403199	7033	7041	8	15	17.87	268.05
6505011403199	7042	7044	2	30	17.87	536.10
6505011403199	7076	7085	9	16	17.87	285.92
6505011403199	7098	7104	6	16	17.87	285.92
6505011403199	7125	7128	3	24	17.87	428.88
6505011403199	7156	7166	10	24	17.87	428.88
6505011403199	7201	7209	8	30	17.87	536.10
6505011403199	7229	7236	7	24	17.87	428.88
6505011403199	7281	7292	11	10	17.87	178.70
6505011403199	7292	7294	2	8	17.87	142.96
6505011403199	7306	7308	2	6	17.87	107.22
6505011403199	7320	7322	2	12	17.87	214.44
6505011403199	7328	7338	10	8	17.87	142.96
			131	311		5557.57
6505010396320	6330	6349	19	16	36.01	576.16
6505010396320	6307	6311	4	6	36.01	216.06
6505010396320	6357	7001	9	10	36.01	360.10
6505010396320	7008	7016	8	18	36.01	648.18
6505010396320	7016	7026	10	6	36.01	216.06
6505010396320	7049	7056	7	16	36.01	576.16
6505010396320	7078	7084	6	9	36.01	324.09
6505010396320	7120	7131	11	15	36.01	540.15
6505010396320	7132	7134	2	6	36.01	216.06
6505010396320	7138	7144	6	7	36.01	252.07

NSN	OJD	RJD	OST	QTY	UP	EP
6505010396320	7159	7167	8	12	36.01	432.12
6505010396320	7177	7191	14	6	36.01	216.06
6505010396320	7195	7203	8	10	36.01	360.10
6505010396320	7231	7240	9	8	36.01	288.08
6505010396320	7248	7261	13	9	36.01	324.09
			134	154		5545.54
6505009316646	6342	6352	10	6	120.96	725.76
6505009316646	7016	7026	10	4	120.96	483.84
6505009316646	7035	7056	21	2	120.96	241.92
6505009316646	7055	7061	6	2	120.96	241.92
6505009316646	7063	7070	7	4	120.96	483.84
6505009316646	7120	7131	11	2	120.96	241.92
6505009316646	7146	7155	9	2	120.96	241.92
6505009316646	7159	7167	8	4	120.96	483.84
6505009316646	7195	7203	8	2	120.96	241.92
6505009316646	7202	7210	8	2	120.96	241.92
6505009316646	7225	7231	6	2	120.96	241.92
6505009316646	7237	7246	9	2	120.96	241.92
6505009316646	7248	7283	35	4	120.96	483.84
			148	38		4596.48
6505010919624	6310	6317	7	24	16.27	390.48
6505010919624	6296	6304	8	12	16.27	195.24
6505010919624	7008	7016	8	24	16.27	390.48
6505010919624	7071	7077	6	24	16.27	390.48
6505010919624	7131	7134	3	12	16.27	195.24
6505010919624	7138	7144	6	24	16.27	390.48
6505010919624	7170	7180	10	12	16.27	195.24
6505010919624	7187	7190	3	24	16.27	390.48
6505010919624	7195	7203	8	24	16.27	390.48
6505010919624	7237	7246	9	24	16.27	390.48
6505010919624	7251	7258	7	12	16.27	195.24
6505010919624	6330	6349	19	36	16.97	610.92
			94	252		4125.24
6505011419463	6272	6281	9	50	5.86	293.00
6505011419463	6279	6297	18	50	5.86	293.00
6505011419463	6289	6295	6	50	5.86	293.00
6505011419463	6332	6337	5	50	5.86	293.00
6505011419463	7009	7021	12	50	5.86	293.00
6505011419463	7057	7063	6	50	5.86	293.00
6505011419463	7103	7113	10	30	5.86	175.80
6505011419463	7124	7134	10	30	5.86	175.80
6505011419463	7072	7077	5	30	5.86	175.80
6505011419463	7133	7140	7	30	5.86	175.80
6505011419463	7173	7191	18	60	5.86	351.60
6505011419463	7178	7191	13	50	5.86	293.00
6505011419463	7219	7225	6	30	5.86	175.80
6505011419463	7237	7246	9	40	5.86	234.40

NSN	OJD	RJD	OST	QTY	UP	EP
6505011419463	7253	7261	8	60	5.86	351.60
			142	660		3867.60
6505010715559	6310	6317	7	6	41.89	251.34
6505010715559	6357	7001	9	6	41.89	251.34
6505010715559	7008	7016	8	8	41.89	335.12
6505010715559	7020	7028	8	6	41.89	251.34
6505010715559	7071	7077	6	10	41.89	418.90
6505010715559	7138	7144	6	12	41.89	502.68
6505010715559	7159	7167	8	24	41.89	1005.36
6505010715559	7195	7203	8	12	41.89	502.68
6505010715559	7237	7246	9	8	41.89	335.12
			69	92		3853.88
6505008901355	6279	6287	8	5	29.77	148.85
6505008901355	6289	6295	6	8	29.77	238.16
6505008901355	6307	6311	4	12	29.77	357.24
6505008901355	6357	7001	9	12	29.77	357.24
6505008901355	7016	7026	10	6	29.77	178.62
6505008901355	7035	7056	21	6	29.77	178.62
6505008901355	7049	7056	7	12	29.77	357.24
6505008901355	7120	7134	14	10	29.77	297.70
6505008901355	7138	7144	6	8	29.77	238.16
6505008901355	7153	7177	24	12	29.77	357.24
6505008901355	7187	7190	3	12	29.77	357.24
6505008901355	7216	7219	3	12	29.77	357.24
			115	115		3423.55
6505010375607	6279	6287	8	24	8.86	212.64
6505010375607	6296	6330	34	24	8.86	212.64
6505010375607	6321	6328	7	36	8.86	318.96
6505010375607	6342	6352	10	24	8.86	212.64
6505010375607	7008	7032	24	12	8.86	106.32
6505010375607	7020	7033	13	36	8.86	318.96
6505010375607	7055	7061	6	2	8.86	17.72
6505010375607	7103	7112	9	12	8.86	106.32
6505010375607	7121	7131	10	24	8.86	212.64
6505010375607	7131	7134	3	24	8.86	212.64
6505010375607	7170	7180	10	36	8.86	318.96
6505010375607	7177	7191	14	24	8.86	212.64
6505010375607	7202	7210	8	24	8.86	212.64
6505010375607	7225	7231	6	24	8.86	212.64
6505010375607	7231	7240	9	24	8.86	212.64
6505010375607	7251	7258	7	12	8.86	106.32
6505010375607	7261	7288	27	24	8.86	212.64
			205	386		3419.96
6505010628010	7027	7036	9	12	36.97	443.64
6505010628010	7079	7090	11	12	36.97	443.64
6505010628010	7132	7134	2	24	36.97	887.28

NSN	OJD	RJD	OBT	QTY	UP	EP
6505010628010	7160	7180	20	12	36.97	443.64
6505010628010	7177	7191	14	8	36.97	295.76
6505010628010	7216	7219	3	12	36.97	443.64
6505010628010	7237	7246	9	12	36.97	443.64
			68	92		3401.24
6550011604995	6311	6317	6	36	19.99	719.64
6550011604995	6343	6356	13	24	19.99	479.76
6550011604995	7072	7079	7	36	19.99	719.64
6550011604995	7121	7152	31	12	19.99	239.88
6550011604995	7138	7151	13	12	19.99	239.88
6550011604995	7218	7301	83	24	19.99	479.76
			153	144		2878.56
6505010925321	6272	6277	5	8	33.89	271.12
6505010925321	6311	6317	6	8	33.89	271.12
6505010925321	6358	7001	8	8	33.89	271.12
6505010925321	7021	7028	7	4	33.89	135.56
6505010925321	7027	7037	10	4	33.89	135.56
6505010925321	7072	7078	6	8	33.89	271.12
6505010925321	7124	7131	7	16	33.89	542.24
6505010925321	7138	7144	6	16	33.89	542.24
6505010925321	7208	7219	11	6	33.89	203.34
6505010925321	7237	7246	9	6	33.89	203.34
6505010925321	7273	7288	15	12	33.89	406.68
			90	96		3253.44
6505011230984	7217	7222	5	12	29.23	350.76
6505011230984	6296	6304	8	6	29.23	175.38
6505011230984	6310	6317	7	6	29.23	175.38
6505011230984	6330	6349	19	4	29.23	116.92
6505011230984	7008	7016	8	10	29.23	292.30
6505011230984	7041	7051	10	6	29.23	175.38
6505011230984	7063	7071	8	6	29.23	175.38
6505011230984	7103	7112	9	10	29.23	292.30
6505011230984	7131	7134	3	4	29.23	116.92
6505011230984	7146	7155	9	8	29.23	233.84
6505011230984	7170	7180	10	12	29.23	350.76
6505011230984	7177	7191	14	12	29.23	350.76
6505011230984	7272	7288	16	12	29.23	350.76
			126	108		3156.84
6505001656545	6289	6297	8	6	36.17	217.02
6505001656545	6310	6317	7	6	36.17	217.02
6505001656545	6329	6349	20	8	36.17	289.36
6505001656545	7035	7056	21	10	36.17	361.70
6505001656545	7055	7061	6	12	36.17	434.04
6505001656545	7120	7131	11	8	36.17	289.36
6505001656545	7132	7134	2	6	36.17	217.02
6505001656545	7146	7165	19	6	36.17	217.02

NSN	OJD	RJD	OST	QTY	UP	EP
6505001656545	7157	7167	10	6	36.17	217.02
6505001656545	7231	7240	9	6	36.17	217.02
6505001656545	7016	7026	10	6	36.17	217.02
			123	80		2893.60
6505011451272	7198	7201	3	36	48.88	1759.68
6505011451272	7217	7222	5	5	48.88	244.40
6505011451272	7231	7240	9	6	48.88	293.28
6505011451272	7248	7253	5	10	48.88	488.80
			22	57		2786.16
6505010701493	6272	6276	4	1	58.82	58.82
6505010701493	6297	6312	15	5	58.82	294.10
6505010701493	6311	6317	6	3	58.82	176.46
6505010701493	6358	7001	8	6	58.82	352.92
6505010701493	7057	7063	6	6	58.82	352.92
6505010701493	7104	7112	8	6	58.82	352.92
6505010701493	7138	7154	16	10	58.82	588.20
6505010701493	7188	7190	2	4	58.82	235.28
6505010701493	7195	7203	8	6	58.82	352.92
			73	47		2764.54
6505011169245	6272	6276	4	24	4.72	113.28
6505011169245	6307	6311	4	36	4.72	169.92
6505011169245	6332	6336	4	36	4.72	169.92
6505011169245	6358	7001	8	24	4.72	113.28
6505011169245	7009	7016	7	24	4.72	113.28
6505011169245	7021	7028	7	56	4.72	264.32
6505011169245	7050	7056	6	36	4.72	169.92
6505011169245	7072	7078	6	48	4.72	226.56
6505011169245	7103	7112	9	56	4.72	264.32
6505011169245	7121	7131	10	48	4.72	226.56
6505011169245	7159	7167	8	48	4.72	226.56
6505011169245	7202	7210	8	36	4.72	169.92
6505011169245	7218	7223	5	48	4.72	226.56
6505011169245	7253	7261	8	36	4.72	169.92
			94	556		2624.32
6505010034119	6296	6304	8	12	25.80	309.60
6505010034119	7049	7056	7	12	25.80	309.60
6505010034119	7078	7084	6	12	25.80	309.60
6505010034119	7132	7134	2	24	25.80	619.20
6505010034119	7153	7177	24	12	25.80	309.60
6505010034119	7177	7191	14	12	25.80	309.60
6505010034119	7237	7246	9	6	25.80	154.80
6505010034119	7272	7288	16	6	25.80	154.80
			86	96		2476.80
6505001335443	6280	6297	17	80	5.73	458.40
6505001335443	6322	6325	3	60	5.73	343.80

NSN	OJD	RJD	OST	QTY	UP	EP
6505001335443	7033	7041	8	30	5.73	171.90
6505001335443	7098	7104	6	30	5.73	171.90
6505001335443	7125	7128	3	20	5.73	114.60
6505001335443	7156	7166	10	80	5.73	458.40
6505001335443	7042	7051	9	20	5.73	114.60
6505001335443	7229	7236	7	40	5.73	229.20
6505001335443	7281	7292	11	10	5.73	57.30
6505001335443	7292	7294	2	10	5.73	57.30
6505001335443	7306	7308	2	10	5.73	57.30
6505001335443	7320	7322	2	30	5.73	171.90
			80	420		2406.60
6505011858848	6311	6317	6	2	194.34	388.68
6505011858848	6332	6336	4	1	194.34	194.34
6505011858848	7009	7021	12	1	194.34	194.34
6505011858848	7057	7063	6	1	194.34	194.34
6505011858848	7103	7113	10	1	194.34	194.34
6505011858848	7146	7154	8	1	194.34	194.34
6505011858848	7159	7175	16	1	194.34	194.34
6505011858848	7195	7203	8	1	194.34	194.34
6505011858848	7253	7261	8	1	194.34	194.34
6505011858848	7273	7288	15	2	194.34	388.68
			93	12		2332.08
6505000519050	6296	6304	8	10	19.10	191.00
6505000519050	6321	6328	7	10	19.10	191.00
6505000519050	6342	6352	10	10	19.10	191.00
6505000519050	7001	7013	12	6	19.10	114.60
6505000519050	7016	7026	10	8	19.10	152.80
6505000519050	7035	7056	21	6	19.10	114.60
6505000519050	7055	7061	6	8	19.10	152.80
6505000519050	7063	7070	7	8	19.10	152.80
6505000519050	7071	7077	6	5	19.10	95.50
6505000519050	7079	7084	5	6	19.10	114.60
6505000519050	7100	7112	12	6	19.10	114.60
6505000519050	7120	7131	11	6	19.10	114.60
6505000519050	7132	7134	2	6	19.10	114.60
6505000519050	7146	7155	9	6	19.10	114.60
6505000519050	7177	7191	14	6	19.10	114.60
6505000519050	7225	7231	6	6	19.10	114.60
6505000519050	7248	7253	5	6	19.10	114.60
			151	119		2272.90
6505000035112	6342	6352	10	5	31.85	159.25
6505000035112	7016	7026	10	6	31.85	191.10
6505000035112	7035	7056	21	6	31.85	191.10
6505000035112	7041	7051	10	6	31.85	191.10
6505000035112	7100	7112	12	5	31.85	159.25
6505000035112	7120	7131	11	6	31.85	191.10
6505000035112	7153	7177	24	6	31.85	191.10

NSN	OJD	RJD	OST	QTY	UP	EP
6505000035112	7187	7190	3	6	31.85	191.10
6505000035112	7208	7215	7	8	31.85	254.80
6505000035112	7216	7219	3	10	31.85	318.50
6505000035112	7272	7288	16	4	31.85	127.40
			127	68		2165.80
6505011966212	6289	6295	6	6	16.37	98.22
6505011966212	6321	6328	7	6	16.37	98.22
6505011966212	6342	6352	10	6	16.37	98.22
6505011966212	6357	7001	9	12	16.37	196.44
6505011966212	7055	7061	6	12	16.37	196.44
6505011966212	7104	7112	8	12	16.37	196.44
6505011966212	7132	7134	2	12	16.37	196.44
6505011966212	7177	7191	14	12	16.37	196.44
6505011966212	7195	7203	8	12	16.37	196.44
6505011966212	7202	7210	8	12	16.37	196.44
6505011966212	7248	7253	5	12	16.37	196.44
6505011966212	7267	7288	21	12	16.37	196.44
			104	126		2062.62
6505011742384	6358	7001	8	18	8.66	155.88
6505011742384	7020	7028	8	18	8.66	155.88
6505011742384	7027	7037	10	18	8.66	155.88
6505011742384	7036	7044	8	12	8.66	103.92
6505011742384	7050	7056	6	12	8.66	103.92
6505011742384	7103	7112	9	18	8.66	155.88
6505011742384	7121	7131	10	18	8.66	155.88
6505011742384	7133	7154	21	36	8.66	311.76
6505011742384	7159	7167	8	36	8.66	311.76
6505011742384	7218	7223	5	16	8.66	138.56
6505011742384	7251	7258	7	36	8.66	311.76
			100	238		2061.08
6505012045417	6296	6304	8	12	18.55	222.60
6505012045417	6342	6352	10	24	18.55	445.20
6505012045417	6357	7009	17	24	18.55	445.20
6505012045417	7078	7084	6	6	18.55	111.30
6505012045417	7208	7215	7	4	18.55	74.20
6505012045417	7216	7219	3	6	18.55	111.30
6505012045417	7231	7240	9	6	18.55	111.30
6505012045417	7248	7253	5	6	18.55	111.30
6505012045417	7261	7268	7	10	18.55	185.50
6505012045417	7267	7288	21	12	18.55	222.60
			93	110		2040.50
6505011385646	6321	6328	7	10	20.43	204.30
6505011385646	6342	6356	14	10	20.43	204.30
6505011385646	7001	7013	12	10	20.43	204.30
6505011385646	7049	7056	7	4	20.43	81.72
6505011385646	7100	7112	12	18	20.43	367.74

NSN	OJD	RJD	OST	QTY	UP	EP
6505011385646	7132	7134	2	18	20.43	367.74
6505011385646	7216	7219	3	12	20.43	245.16
6505011385646	6357	7001	9	10	20.43	204.30
6505011385646	7248	7253	5	6	20.43	122.58
			71	98		2002.14
6505011374627	6310	6317	7	8	19.56	156.48
6505011374627	6342	6352	10	12	19.56	234.72
6505011374627	7020	7028	8	10	19.56	195.60
6505011374627	7049	7056	7	12	19.56	234.72
6505011374627	7078	7084	6	6	19.56	117.36
6505011374627	7121	7131	10	6	19.56	117.36
6505011374627	7131	7134	3	12	19.56	234.72
6505011374627	7138	7144	6	12	19.56	234.72
6505011374627	7225	7231	6	12	19.56	234.72
6505011374627	7261	7268	7	12	19.56	234.72
			70	102		1995.12
6505010301647	6329	6349	20	36	8.16	293.76
6505010301647	6357	7001	9	18	8.16	146.88
6505010301647	7001	7013	12	18	8.16	146.88
6505010301647	7016	7026	10	12	8.16	97.92
6505010301647	7035	7056	21	12	8.16	97.92
6505010301647	7071	7077	6	24	8.16	195.84
6505010301647	7120	7131	11	12	8.16	97.92
6505010301647	7132	7134	2	24	8.16	195.84
6505010301647	7153	7177	24	12	8.16	97.92
6505010301647	7160	7180	20	12	8.16	97.92
6505010301647	7177	7191	14	12	8.16	97.92
6505010301647	7225	7231	6	12	8.16	97.92
6505010301647	7231	7240	9	12	8.16	97.92
6505010301647	7261	7268	7	24	8.16	195.84
			171	240		1958.40
6515010891069	7218	7223	5	12	18.72	224.64
6515010891069	6321	6328	7	24	18.72	449.28
6515010891069	7072	7078	6	24	18.72	449.28
6515010891069	7133	7140	7	12	18.72	224.64
6515010891069	7159	7167	8	10	18.72	187.20
6515010891069	7208	7215	7	10	18.72	187.20
6515010891069	7253	7261	8	12	18.72	224.64
			48	104		1946.88
6505011481992	6296	6304	8	1	148.90	148.90
6505011481992	6329	6349	20	3	148.90	446.70
6505011481992	7120	7166	46	3	148.90	446.70
6505011481992	7146	7166	20	3	148.90	446.70
6505011481992	7177	7191	14	3	148.90	446.70
			108	13		1935.70

NSN	OJD	RJD	OST	QTY	UP	EP
6505010830900	6279	6287	8	12	13.96	167.52
6505010830900	6307	6311	4	6	13.96	83.76
6505010830900	6329	6349	20	24	13.96	335.04
6505010830900	6342	6352	10	12	13.96	167.52
6505010830900	7027	7036	9	12	13.96	167.52
6505010830900	7063	7070	7	12	13.96	167.52
6505010830900	7157	7173	16	12	13.96	167.52
6505010830900	7160	7180	20	12	13.96	167.52
6505010830900	7177	7191	14	24	13.96	335.04
6505010830900	7237	7246	9	12	13.96	167.52
			117	138		1926.48
6505011561775	6279	6287	8	24	4.45	106.80
6505011561775	6321	6349	28	12	4.45	53.40
6505011561775	6342	6352	10	24	4.45	106.80
6505011561775	7001	7040	39	72	4.45	320.40
6505011561775	7016	7040	24	72	4.45	320.40
6505011561775	7132	7134	2	48	4.45	213.60
6505011561775	7138	7144	6	48	4.45	213.60
6505011561775	7177	7191	14	48	4.45	213.60
6505011561775	7195	7203	8	24	4.45	106.80
6505011561775	7216	7219	3	60	4.45	267.00
			142	432		1922.40
6505002213393	6321	6328	7	10	22.13	221.30
6505002213393	6357	7001	9	6	22.13	132.78
6505002213393	7027	7037	10	6	22.13	132.78
6505002213393	7055	7061	6	6	22.13	132.78
6505002213393	7078	7084	6	2	22.13	44.26
6505002213393	7100	7112	12	6	22.13	132.78
6505002213393	7132	7134	2	6	22.13	132.78
6505002213393	7153	7177	24	6	22.13	132.78
6505002213393	7187	7190	3	6	22.13	132.78
6505002213393	7187	7198	11	6	22.13	132.78
6505002213393	7225	7253	28	6	22.13	132.78
6505002213393	7237	7253	16	8	22.13	177.04
6505002213393	7248	7253	5	12	22.13	265.56
			139	86		1903.18
6505010257416	6296	6304	8	6	19.43	116.58
6505010257416	6310	6317	7	20	19.43	388.60
6505010257416	6342	6352	10	20	19.43	388.60
6505010257416	7071	7077	6	12	19.43	233.16
6505010257416	7120	7131	11	12	19.43	233.16
6505010257416	7146	7155	9	6	19.43	116.58
6505010257416	7272	7288	16	6	19.43	116.58
6505010257416	6307	6311	4	4	19.43	77.72
6505010257416	6330	6349	19	10	19.43	194.30
			90	96		1865.28

NSN	DJD	RJD	DST	QTY	UP	EP
6505011354251	6357	7001	9	10	16.59	165.90
6505011354251	7020	7028	8	18	16.59	298.62
6505011354251	7027	7037	10	18	16.59	298.62
6505011354251	7121	7131	10	16	16.59	265.44
6505011354251	7159	7167	8	14	16.59	232.26
6505011354251	7208	7215	7	12	16.59	199.08
6505011354251	7225	7231	6	12	16.59	199.08
6505011354251	7251	7258	7	12	16.59	199.08
			65	112		1858.08
6505011908688	6279	6287	8	8	21.06	168.48
6505011908688	6289	6297	8	8	21.06	168.48
6505011908688	6310	6317	7	4	21.06	84.24
6505011908688	6330	6349	19	8	21.06	168.48
6505011908688	6342	6352	10	8	21.06	168.48
6505011908688	7027	7037	10	6	21.06	126.36
6505011908688	7055	7061	6	8	21.06	168.48
6505011908688	7120	7131	11	10	21.06	210.60
6505011908688	7159	7167	8	14	21.06	294.84
6505011908688	7217	7222	5	12	21.06	252.72
			92	86		1811.16
6505011544486	6329	6349	20	12	23.71	284.52
6505011544486	6357	7001	9	12	23.71	284.52
6505011544486	7001	7013	12	24	23.71	569.04
6505011544486	7063	7090	27	12	23.71	284.52
6505011544486	7248	7253	5	6	23.71	142.26
			73	66		1564.86
6505010842027	7041	7051	10	8	21.91	175.28
6505010842027	7063	7071	8	8	21.91	175.28
6505010842027	7121	7144	23	8	21.91	175.28
6505010842027	7132	7144	12	8	21.91	175.28
6505010842027	7170	7180	10	4	21.91	87.64
6505010842027	7195	7203	8	6	21.91	131.46
6505010842027	7208	7215	7	6	21.91	131.46
6505010842027	7217	7223	6	8	21.91	175.28
6505010842027	7248	7253	5	6	21.91	131.46
6505010842027	7272	7288	16	6	21.91	131.46
			105	68		1489.88
6505010498881	6289	6295	6	24	4.57	109.68
6505010498881	6332	6336	4	24	4.57	109.68
6505010498881	7009	7016	7	48	4.57	219.36
6505010498881	7021	7026	5	48	4.57	219.36
6505010498881	7064	7070	6	12	4.57	54.84
6505010498881	7103	7113	10	48	4.57	219.36
6505010498881	7133	7140	7	24	4.57	109.68
6505010498881	7159	7167	8	36	4.57	164.52
6505010498881	7178	7191	13	36	4.57	164.52

NSN	OJD	RJD	OST	QTY	UP	EP
6505010498881	7253	7261	8	24	4.57	109.68
			74	324		1480.68
6505011651483	6272	6276	4	20	10.48	209.60
6505011651483	6289	6297	8	12	10.48	125.76
6505011651483	6332	6336	4	12	10.48	125.76
6505011651483	7009	7023	14	24	10.48	251.52
6505011651483	7057	7063	6	12	10.48	125.76
6505011651483	7079	7084	5	12	10.48	125.76
6505011651483	7173	7180	7	12	10.48	125.76
6505011651483	7203	7210	7	12	10.48	125.76
6505011651483	7237	7246	9	12	10.48	125.76
6505011651483	7272	7288	16	12	10.48	125.76
			80	140		1467.20
6505011065973	7132	7134	2	24	7.88	189.12
6505011065973	6307	6311	4	12	7.88	94.56
6505011065973	6321	6328	7	24	7.88	189.12
6505011065973	7008	7016	8	24	7.88	189.12
6505011065973	7016	7026	10	12	7.88	94.56
6505011065973	7049	7056	7	16	7.88	126.08
6505011065973	7078	7085	7	12	7.88	94.56
6505011065973	7169	7176	7	6	7.88	47.28
6505011065973	7177	7191	14	6	7.88	47.28
6505011065973	7195	7203	8	10	7.88	78.80
6505011065973	7208	7215	7	16	7.88	126.08
6505011065973	7237	7246	9	8	7.88	63.04
6505011065973	7272	7288	16	16	7.88	126.08
			106	186		1465.68
6505010836613	6296	6304	8	24	6.65	159.60
6505010836613	6342	6352	10	24	6.65	159.60
6505010836613	7008	7016	8	24	6.65	159.60
6505010836613	7035	7056	21	24	6.65	159.60
6505010836613	7063	7070	7	12	6.65	79.80
6505010836613	7063	7070	7	12	6.65	79.80
6505010836613	7103	7112	9	12	6.65	79.80
6505010836613	7121	7131	10	12	6.65	79.80
6505010836613	7131	7134	3	12	6.65	79.80
6505010836613	7170	7180	10	24	6.65	159.60
6505010836613	7177	7191	14	24	6.65	159.60
6505010836613	7225	7231	6	12	6.65	79.80
			113	216		1436.40
6505012036240	7055	7061	6	6	33.61	201.66
6505012036240	7063	7071	8	6	33.61	201.66
6505012036240	7103	7112	9	6	33.61	201.66
6505012036240	7131	7134	3	6	33.61	201.66
6505012036240	7177	7191	14	6	33.61	201.66
6505012036240	7217	7222	5	6	33.61	201.66

NSN	OJD	RJD	OST	QTY	UP	EP
6505012036240	7251	7258	7	6	33.61	201.66
			52	42		1411.62

APPENDIX C

SAMPLE OUTPUT FROM RAW DATA FILE
WITH BY-LINE TOTALS

NSN	OST	QTY	TO	UP	EP
6505011607702	145	564	17	\$37.71	\$21,268.44
6505011456757	185	37	16	\$502.40	\$18,588.80
6505011197848	169	616	15	\$27.61	\$17,007.76
6505011464174	146	364	13	\$32.17	\$11,709.88
6505009010043	128	121	15	\$93.04	\$11,257.84
6505010503547	145	348	14	\$29.46	\$10,252.08
6505011357373	124	336	12	\$27.73	\$9,317.28
6505012208416	96	252	10	\$35.79	\$9,019.08
6505001050372	35	276	5	\$28.26	\$7,799.76
6505012149062	115	306	13	\$24.95	\$7,634.70
6505010723426	115	134	13	\$52.35	\$7,014.90
6505011263842	118	288	9	\$22.23	\$6,402.24
6505010396321	152	126	15	\$50.10	\$6,312.60
6505010906797	101	564	13	\$11.19	\$6,311.16
6505010402278	110	68	11	\$85.40	\$5,807.20
6505011403199	131	311	20	\$17.87	\$5,557.57
6505010396320	134	154	15	\$36.01	\$5,545.54
6505009316646	148	38	13	\$120.96	\$4,596.48
6505010919624	94	252	12	\$16.27	\$4,100.04
6505011419463	142	660	15	\$5.86	\$3,867.60
6505010715559	69	92	9	\$41.89	\$3,853.88
6505008901355	115	115	12	\$29.77	\$3,423.55
6505010375607	205	386	17	\$8.86	\$3,419.96
6505010628010	68	92	7	\$36.97	\$3,401.24
6505011604995	173	168	7	\$19.99	\$3,358.32
6505010925321	90	96	11	\$33.89	\$3,253.44
6505011230984	126	108	13	\$29.23	\$3,156.84
6505001656545	123	80	11	\$36.17	\$2,893.60
6505011451272	22	57	4	\$48.88	\$2,786.16
6505010701493	73	47	9	\$58.82	\$2,764.54
6505011169245	94	556	14	\$4.72	\$2,624.32
6505010034119	86	96	8	\$25.80	\$2,476.80
6505001335443	80	420	12	\$5.73	\$2,406.60
6505011858848	93	12	10	\$194.34	\$2,332.08
6505000519050	151	119	17	\$19.10	\$2,272.90
6505000035112	127	68	11	\$31.85	\$2,165.80
6505011966212	104	126	12	\$16.37	\$2,062.62
6505011742384	100	238	11	\$8.66	\$2,061.08
6505012045417	93	110	10	\$18.55	\$2,040.50
6505011385646	71	98	9	\$20.43	\$2,002.14
6505011374627	70	102	10	\$19.56	\$1,995.12
6505010301647	171	240	14	\$8.16	\$1,958.40
6515010891069	48	104	7	\$18.72	\$1,946.88
6505011481992	108	13	5	\$148.90	\$1,935.70
6505010830900	117	138	10	\$13.96	\$1,926.48
6505011561775	142	432	10	\$4.45	\$1,922.40
6505002213393	139	86	13	\$22.13	\$1,903.18
6505010257416	90	96	9	\$19.43	\$1,865.28
6505011354251	65	112	8	\$16.59	\$1,858.08
6505011908688	92	86	10	\$21.06	\$1,811.16
6505011544486	73	66	5	\$23.71	\$1,564.86
6505010842027	105	68	10	\$21.91	\$1,489.88
6505010498881	74	324	10	\$4.57	\$1,480.68
6505011651483	80	140	10	\$10.48	\$1,467.20
6505011065973	106	186	13	\$7.88	\$1,465.68
6505010836613	113	216	12	\$6.65	\$1,436.40
6505012036240	52	42	7	\$33.61	\$1,411.62

KEY:

NSN: National Stock Number.

OST: Order-Ship Time.

QTY: Quantity (Total quantity ordered for that line in FY87).

TO: Times Ordered (Total number of times line ordered in FY87).

UP: Unit Price.

EP: Extended Price.

APPENDIX D

SAMPLE OUTPUT WITH RESULTS OF COMPUTATIONS
UNDER THE PRESENT SYSTEM

NSN	OST	QTY	TD	UP	EP	AOST	HC	OC
6505011607702	145	564	17	\$37.71	\$21,268.44	8.53	\$4,253.69	\$76.50
6505011456757	185	37	16	\$502.40	\$18,588.80	11.56	\$3,717.76	\$72.00
6505011197848	169	616	15	\$27.61	\$17,007.76	11.27	\$3,401.55	\$67.50
6505011464174	146	364	13	\$32.17	\$11,709.88	11.23	\$2,341.98	\$58.50
6505009010043	128	121	15	\$93.04	\$11,257.84	8.53	\$2,251.57	\$67.50
6505010503547	145	348	14	\$29.46	\$10,252.08	10.36	\$2,050.42	\$63.00
6505011357373	124	336	12	\$27.73	\$9,317.28	10.33	\$1,863.46	\$54.00
6505012208416	96	252	10	\$35.79	\$9,019.08	9.60	\$1,803.82	\$45.00
6505001050372	35	276	5	\$28.26	\$7,799.76	7.00	\$1,559.95	\$22.50
6505012149062	115	306	13	\$24.95	\$7,634.70	8.85	\$1,526.94	\$58.50
6505010723426	115	134	13	\$52.35	\$7,014.90	8.85	\$1,402.98	\$58.50
6505011263842	118	288	9	\$22.23	\$6,402.24	13.11	\$1,280.45	\$40.50
6505010396321	152	126	15	\$50.10	\$6,312.60	10.13	\$1,262.52	\$67.50
6505010906797	101	564	13	\$11.19	\$6,311.16	7.77	\$1,262.23	\$58.50
6505010402278	110	68	11	\$85.40	\$5,807.20	10.00	\$1,161.44	\$49.50
6505011403199	131	311	20	\$17.87	\$5,557.57	6.55	\$1,111.51	\$90.00
6505010396320	134	154	15	\$36.01	\$5,545.54	8.93	\$1,109.11	\$67.50
6505009316646	148	38	13	\$120.96	\$4,596.48	11.38	\$919.30	\$58.50
6505010919624	94	252	12	\$16.27	\$4,100.04	7.83	\$820.01	\$54.00
6505011419463	142	660	15	\$5.86	\$3,867.60	9.47	\$773.52	\$67.50
6505010715559	69	92	9	\$41.89	\$3,853.88	7.67	\$770.78	\$40.50
6505008901355	115	115	12	\$29.77	\$3,423.55	9.58	\$684.71	\$54.00
6505010375607	205	386	17	\$8.86	\$3,419.96	12.06	\$683.99	\$76.50
6505010628010	68	92	7	\$36.97	\$3,401.24	9.71	\$680.25	\$31.50
6505011604995	173	168	7	\$19.99	\$3,358.32	24.71	\$671.66	\$31.50
6505010925321	90	96	11	\$33.89	\$3,253.44	8.18	\$650.69	\$49.50
6505011230984	126	108	13	\$29.23	\$3,156.84	9.69	\$631.37	\$58.50
6505001656545	123	80	11	\$36.17	\$2,893.60	11.18	\$578.72	\$49.50
6505011451272	22	57	4	\$48.88	\$2,786.16	5.50	\$557.23	\$18.00
6505010701493	73	47	9	\$58.82	\$2,764.54	8.11	\$552.91	\$40.50
6505011169245	94	556	14	\$4.72	\$2,624.32	6.71	\$524.86	\$63.00
6505010034119	86	96	8	\$25.80	\$2,476.80	10.75	\$495.36	\$36.00
6505001335443	80	420	12	\$5.73	\$2,406.60	6.67	\$481.32	\$54.00
6505011858848	93	12	10	\$194.34	\$2,332.08	9.30	\$466.42	\$45.00
6505000519050	151	119	17	\$19.10	\$2,272.90	8.88	\$454.58	\$76.50
6505000035112	127	68	11	\$31.85	\$2,165.80	11.55	\$433.16	\$49.50
6505011966212	104	126	12	\$16.37	\$2,062.62	8.67	\$412.52	\$54.00
6505011742384	100	238	11	\$8.66	\$2,061.08	9.09	\$412.22	\$49.50
6505012045417	93	110	10	\$18.55	\$2,040.50	9.30	\$408.10	\$45.00
6505011385646	71	98	9	\$20.43	\$2,002.14	7.89	\$400.43	\$40.50
6505011374627	70	102	10	\$19.56	\$1,995.12	7.00	\$399.02	\$45.00
6505010301647	171	240	14	\$8.16	\$1,958.40	12.21	\$391.68	\$63.00
6515010891069	48	104	7	\$18.72	\$1,946.88	6.86	\$389.38	\$31.50
6505011481992	108	13	5	\$148.90	\$1,935.70	21.60	\$387.14	\$22.50
6505010830900	117	138	10	\$13.96	\$1,926.48	11.70	\$385.30	\$45.00
6505011561775	142	432	10	\$4.45	\$1,922.40	14.20	\$384.48	\$45.00
6505002213393	139	86	13	\$22.13	\$1,903.18	10.69	\$380.64	\$58.50
6505010257416	90	96	9	\$19.43	\$1,865.28	10.00	\$373.06	\$40.50
6505011354251	65	112	8	\$16.59	\$1,858.08	8.12	\$371.62	\$36.00
6505011908688	92	86	10	\$21.06	\$1,811.16	9.20	\$362.23	\$45.00
6505011544486	73	66	5	\$23.71	\$1,564.86	14.60	\$312.97	\$22.50
6505010842027	105	68	10	\$21.91	\$1,489.88	10.50	\$297.98	\$45.00
6505010498881	74	324	10	\$4.57	\$1,480.68	7.40	\$296.14	\$45.00
6505011651483	80	140	10	\$10.48	\$1,467.20	8.00	\$293.44	\$45.00
6505011065973	106	186	13	\$7.88	\$1,465.68	8.15	\$293.14	\$58.50
6505010836613	113	216	12	\$6.65	\$1,436.40	9.42	\$287.28	\$54.00
6505012036240	52	42	7	\$33.61	\$1,411.62	7.43	\$282.32	\$31.50

KEY:

NSN: National Stock Number.
OST: Order-Ship Time.
QTY: Quantity (Total quantity ordered for that line in FY87).
TD: Times Ordered (Total number of transactions for that line in FY87).
UP: Unit Price.
EP: Extended Price (QTY X UP).
AOST: Average Order-Ship Time.
HC: Holding Cost.
OC: Order Cost.

APPENDIX E

SAMPLE OUTPUT OF A ITEMS
IN ABC ANALYSIS

NSN	QTY	UP	EP
6505011607702	564	\$37.71	\$21,268.44
6505011456757	37	\$502.40	\$18,588.80
6505011197848	616	\$27.61	\$17,007.76
6505011464174	364	\$32.17	\$11,709.88
6505009010043	121	\$93.04	\$11,257.84
6505010503547	348	\$29.46	\$10,252.08
6505011357373	336	\$27.73	\$9,317.28
6505012208416	252	\$35.79	\$9,019.08
6505001050372	276	\$28.26	\$7,799.76
6505012149062	306	\$24.95	\$7,634.70
6505010723426	134	\$52.35	\$7,014.90
6505011263842	288	\$22.23	\$6,402.24
6505010396321	126	\$50.10	\$6,312.60
6505010906797	564	\$11.19	\$6,311.16
6505010402278	68	\$85.40	\$5,807.20
6505011403199	311	\$17.87	\$5,557.57
6505010396320	154	\$36.01	\$5,545.54
6505009316646	38	\$120.96	\$4,596.48
6505010919624	252	\$16.27	\$4,100.04
6505011419463	660	\$5.86	\$3,867.60
6505010715559	92	\$41.89	\$3,853.88
6505008901355	115	\$29.77	\$3,423.55
6505010375607	386	\$8.86	\$3,419.96
6505010628010	92	\$36.97	\$3,401.24
6550011604995	168	\$19.99	\$3,358.32
6505010925321	96	\$33.89	\$3,253.44
6505011230984	108	\$29.23	\$3,156.84
6505001656545	80	\$36.17	\$2,893.60
6505011451272	57	\$48.88	\$2,786.16
6505010701493	47	\$58.82	\$2,764.54
6505011169245	556	\$4.72	\$2,624.32
6505010034119	96	\$25.80	\$2,476.80
6505001335443	420	\$5.73	\$2,406.60
6505011858848	12	\$194.34	\$2,332.08
6505000519050	119	\$19.10	\$2,272.90
6505000035112	68	\$31.85	\$2,165.80
6505011966212	126	\$16.37	\$2,062.62
6505011742384	238	\$8.66	\$2,061.08
6505012045417	110	\$18.55	\$2,040.50
6505011385646	98	\$20.43	\$2,002.14
6505011374627	102	\$19.56	\$1,995.12
6505010301647	240	\$8.16	\$1,958.40
6515010891069	104	\$18.72	\$1,946.88
6505011481992	13	\$148.90	\$1,935.70
6505010830900	138	\$13.96	\$1,926.48
6505011561775	432	\$4.45	\$1,922.40
6505002213393	86	\$22.13	\$1,903.18
6505010257416	96	\$19.43	\$1,865.28
6505011354251	112	\$16.59	\$1,858.08
6505011908688	86	\$21.06	\$1,811.16
6505011544486	66	\$23.71	\$1,564.86
6505010842027	68	\$21.91	\$1,489.88
6505010498881	324	\$4.57	\$1,480.68
6505011651483	140	\$10.48	\$1,467.20
6505011065973	186	\$7.88	\$1,465.68
6505010836613	216	\$6.65	\$1,436.40
6505012036240	42	\$33.61	\$1,411.62

KEY:

NSN: National Stock Number.
QTY: Quantity (Total quantity ordered for that line in FY87).
UP: Unit Price.
EP: Extended Price.

APPENDIX F

SAMPLE OUTPUT WITH RESULTS OF
ECONOMIC ORDER QUANTITY COMPUTATIONS

NSN	QTY	UP	EP	No	Nu	Nd	N\$	OC	HC
6505011607702	564	\$37.71	\$21,268.44	30.75	18.34	11.87	\$691.77	\$138.35	\$138.35
6505011456757	37	\$502.40	\$18,588.80	28.74	1.29	12.70	\$646.72	\$129.34	\$129.34
6505011197848	616	\$27.61	\$17,007.76	27.49	22.41	13.28	\$618.61	\$123.72	\$123.72
6505011464174	364	\$32.17	\$11,709.88	22.81	15.96	16.00	\$513.30	\$102.66	\$102.66
6505009010043	121	\$93.04	\$11,257.84	22.37	5.41	16.32	\$503.29	\$100.66	\$100.66
6505010503547	348	\$29.46	\$10,252.08	21.35	16.30	17.10	\$480.28	\$96.06	\$96.06
6505011357373	336	\$27.73	\$9,317.28	20.35	16.51	17.94	\$457.86	\$91.57	\$91.57
6505012208416	252	\$35.79	\$9,019.08	20.02	12.59	18.23	\$450.48	\$90.10	\$90.10
6505001050372	276	\$28.26	\$7,799.76	18.62	14.82	19.60	\$418.92	\$83.78	\$83.78
6505012149062	306	\$24.95	\$7,634.70	18.42	16.61	19.81	\$414.46	\$82.89	\$82.89
6505010723426	134	\$52.35	\$7,014.90	17.66	7.59	20.67	\$397.28	\$79.46	\$79.46
6505011263842	288	\$22.23	\$6,402.24	16.87	17.07	21.64	\$379.54	\$75.91	\$75.91
6505010396321	126	\$50.10	\$6,312.60	16.75	7.52	21.79	\$376.87	\$75.37	\$75.37
6505010906797	564	\$11.19	\$6,311.16	16.75	33.68	21.79	\$376.83	\$75.37	\$75.37
6505010402278	68	\$85.40	\$5,807.20	16.07	4.23	22.72	\$361.47	\$72.29	\$72.29
6505011403199	311	\$17.87	\$5,557.57	15.72	19.79	23.22	\$353.62	\$70.72	\$70.72
6505010396320	154	\$36.01	\$5,545.54	15.70	9.81	23.25	\$353.23	\$70.65	\$70.65
6505009316646	38	\$120.96	\$4,596.48	14.29	2.66	25.54	\$321.59	\$64.32	\$64.32
6505010919624	252	\$16.27	\$4,100.04	13.50	18.67	27.04	\$303.73	\$60.75	\$60.75
6505011419463	660	\$5.86	\$3,867.60	13.11	50.34	27.84	\$294.99	\$59.00	\$59.00
6505010715559	92	\$41.89	\$3,853.88	13.09	7.03	27.89	\$294.47	\$58.89	\$58.89
6505008901355	115	\$29.77	\$3,423.55	12.34	9.32	29.59	\$277.54	\$55.51	\$55.51
6505010375607	386	\$8.86	\$3,419.96	12.33	31.31	29.61	\$277.40	\$55.48	\$55.48
6505011628010	92	\$36.97	\$3,401.24	12.29	7.48	29.69	\$276.64	\$55.33	\$55.33
6550011604995	168	\$19.99	\$3,358.32	12.22	13.75	29.88	\$274.89	\$54.98	\$54.98
6505010925321	96	\$33.89	\$3,253.44	12.02	7.98	30.35	\$270.56	\$54.11	\$54.11
6505011230984	108	\$29.23	\$3,156.84	11.84	9.12	30.81	\$266.51	\$53.30	\$53.30
6505001656545	80	\$36.17	\$2,893.60	11.34	7.05	32.19	\$255.16	\$51.03	\$51.03
6505011451272	57	\$48.88	\$2,786.16	11.13	5.12	32.80	\$250.38	\$50.08	\$50.08
6505010701493	47	\$58.82	\$2,764.54	11.08	4.24	32.93	\$249.40	\$49.88	\$49.88
6505011169245	556	\$4.72	\$2,624.32	10.80	51.48	33.80	\$243.00	\$48.60	\$48.60
6505010034119	96	\$25.80	\$2,476.80	10.49	9.15	34.79	\$236.07	\$47.21	\$47.21
6505001335443	420	\$5.73	\$2,406.60	10.34	40.61	35.29	\$232.70	\$46.54	\$46.54
6505011858848	12	\$194.34	\$2,332.08	10.18	1.18	35.85	\$229.07	\$45.81	\$45.81
6505000519050	119	\$19.10	\$2,272.90	10.05	11.84	36.32	\$226.14	\$45.23	\$45.23
6505000035112	68	\$31.85	\$2,165.80	9.81	6.93	37.20	\$220.75	\$44.15	\$44.15
6505011966212	126	\$16.37	\$2,062.62	9.57	13.16	38.12	\$215.43	\$43.09	\$43.09
6505011742384	238	\$8.66	\$2,061.08	9.57	24.87	38.14	\$215.35	\$43.07	\$43.07
6505012045417	110	\$18.55	\$2,040.50	9.52	11.55	38.33	\$214.27	\$42.85	\$42.85
6505011385646	98	\$20.43	\$2,002.14	9.43	10.39	38.69	\$212.25	\$42.45	\$42.45
6505011374627	102	\$19.56	\$1,995.12	9.42	10.83	38.76	\$211.87	\$42.37	\$42.37
6505010301647	240	\$8.16	\$1,958.40	9.33	25.72	39.12	\$209.91	\$41.98	\$41.98
6515010891069	104	\$18.72	\$1,946.88	9.30	11.18	39.24	\$209.30	\$41.86	\$41.86
6505011481992	13	\$148.90	\$1,935.70	9.28	1.40	39.35	\$208.69	\$41.74	\$41.74
6505010830900	138	\$13.96	\$1,926.48	9.25	14.91	39.45	\$208.20	\$41.64	\$41.64
6505011561775	432	\$4.45	\$1,922.40	9.24	46.74	39.49	\$207.98	\$41.60	\$41.60
6505002213393	86	\$22.13	\$1,903.18	9.20	9.35	39.69	\$206.93	\$41.39	\$41.39
6505010257416	96	\$19.43	\$1,865.28	9.11	10.54	40.09	\$204.86	\$40.97	\$40.97
6505011354251	112	\$16.59	\$1,858.08	9.09	12.32	40.17	\$204.47	\$40.89	\$40.89
6505011908688	86	\$21.06	\$1,811.16	8.97	9.59	40.68	\$201.87	\$40.37	\$40.37
6505011544486	66	\$23.71	\$1,564.86	8.34	7.91	43.77	\$187.64	\$37.53	\$37.53
6505010842027	68	\$21.91	\$1,489.88	8.14	8.36	44.85	\$183.09	\$36.62	\$36.62
6505010498881	324	\$4.57	\$1,480.68	8.11	39.94	44.99	\$182.52	\$36.50	\$36.50
6505011651483	140	\$10.48	\$1,467.20	8.08	17.34	45.20	\$181.69	\$36.34	\$36.34
6505011065973	186	\$7.88	\$1,465.68	8.07	23.05	45.22	\$181.60	\$36.32	\$36.32
6505010836613	216	\$6.65	\$1,436.40	7.99	27.03	45.68	\$179.77	\$35.95	\$35.95
6505012036240	42	\$33.61	\$1,411.62	7.92	5.30	46.08	\$178.22	\$35.64	\$35.64

KEY:

NSN: National Stock Number.
QTY: Quantity (Total quantity ordered for that line in FY87).
UP: Unit Price.
EP: Extended Price.
No: EOQ Number of orders to make in the year. (formula from table 2)
Nu: EOQ Number of units per order. (Qty/No)
Nd: EOQ Number of days of supply for each order. (365/No)
N\$: EOQ Dollar value per order. (Nu X UP)
OC: Order Cost.
HC: Holding Cost.

APPENDIX G

SAMPLE OUTPUT WITH RESULTS OF
ECONOMIC PART PERIOD COMPUTATIONS

NSN	QTY	UP	EP	EPP	# ORDERS	HC	OC
6505011607702	564	\$37.71	\$21,268.44	.30	1890.53	\$8,507.38	\$8,507.38
6505011456757	37	\$502.40	\$18,588.80	.02	1652.34	\$7,435.52	\$7,435.52
6505011197848	616	\$27.61	\$17,007.76	.41	1511.80	\$6,803.10	\$6,803.10
6505011464174	364	\$32.17	\$11,709.88	.35	1040.88	\$4,683.95	\$4,683.95
6505009010043	121	\$93.04	\$11,257.84	.12	1000.70	\$4,503.14	\$4,503.14
6505010503547	348	\$29.46	\$10,252.08	.38	911.30	\$4,100.83	\$4,100.83
6505011357373	336	\$27.73	\$9,317.28	.41	828.20	\$3,726.91	\$3,726.91
6505012208416	252	\$35.79	\$9,019.08	.31	801.70	\$3,607.63	\$3,607.63
650501050372	276	\$28.26	\$7,799.76	.40	693.31	\$3,119.90	\$3,119.90
6505012149062	306	\$24.95	\$7,634.70	.45	678.64	\$3,053.88	\$3,053.88
6505010723426	134	\$52.35	\$7,014.90	.21	623.55	\$2,805.96	\$2,805.96
6505011263842	288	\$22.23	\$6,402.24	.51	569.09	\$2,560.90	\$2,560.90
6505010396321	126	\$50.10	\$6,312.60	.22	561.12	\$2,525.04	\$2,525.04
6505010906797	564	\$11.19	\$6,311.16	1.01	560.99	\$2,524.46	\$2,524.46
6505010402278	68	\$85.40	\$5,807.20	.13	516.20	\$2,322.88	\$2,322.88
6505011403199	311	\$17.87	\$5,557.57	.63	494.01	\$2,223.03	\$2,223.03
6505010396320	154	\$36.01	\$5,545.54	.31	492.94	\$2,218.22	\$2,218.22
6505009316646	38	\$120.96	\$4,596.48	.09	408.58	\$1,838.59	\$1,838.59
6505010919624	252	\$16.27	\$4,100.04	.69	364.45	\$1,640.02	\$1,640.02
6505011419463	660	\$5.86	\$3,867.60	1.92	343.79	\$1,547.04	\$1,547.04
6505010715559	92	\$41.89	\$3,853.88	.27	342.57	\$1,541.55	\$1,541.55
6505008901355	115	\$29.77	\$3,423.55	.38	304.32	\$1,369.42	\$1,369.42
6505010375607	386	\$8.86	\$3,419.96	1.27	304.00	\$1,367.98	\$1,367.98
6505010628010	92	\$36.97	\$3,401.24	.30	302.33	\$1,360.50	\$1,360.50
6505011604995	168	\$19.99	\$3,358.32	.56	298.52	\$1,343.33	\$1,343.33
6505010925321	96	\$33.89	\$3,253.44	.33	289.19	\$1,301.38	\$1,301.38
6505011230984	108	\$29.23	\$3,156.84	.38	280.61	\$1,262.74	\$1,262.74
6505001656545	80	\$36.17	\$2,893.60	.31	257.21	\$1,157.44	\$1,157.44
6505011451272	57	\$48.88	\$2,786.16	.23	247.66	\$1,114.46	\$1,114.46
6505010701493	47	\$58.82	\$2,764.54	.19	245.74	\$1,105.82	\$1,105.82
6505011169245	556	\$4.72	\$2,624.32	2.38	233.27	\$1,049.73	\$1,049.73
6505010034119	96	\$25.80	\$2,476.80	.44	220.16	\$990.72	\$990.72
6505001335443	420	\$5.73	\$2,406.60	1.96	213.92	\$962.64	\$962.64
6505011858848	12	\$194.34	\$2,332.08	.06	207.30	\$932.83	\$932.83
6505000519050	119	\$19.10	\$2,272.90	.59	202.04	\$909.16	\$909.16
6505000035112	68	\$31.85	\$2,165.80	.35	192.52	\$866.32	\$866.32
6505011966212	126	\$16.37	\$2,062.62	.69	183.34	\$825.05	\$825.05
6505011742384	238	\$8.66	\$2,061.08	1.30	183.21	\$824.43	\$824.43
6505012045417	110	\$18.55	\$2,040.50	.61	181.38	\$816.20	\$816.20
6505011385646	98	\$20.43	\$2,002.14	.55	177.97	\$800.86	\$800.86
6505011374627	102	\$19.56	\$1,995.12	.58	177.34	\$798.05	\$798.05
6505010301647	240	\$3.16	\$1,958.40	1.38	174.08	\$783.36	\$783.36
6515010891069	104	\$18.72	\$1,946.88	.60	173.06	\$778.75	\$778.75
6505011481792	13	\$148.90	\$1,935.70	.08	172.06	\$774.28	\$774.28
6505010830900	138	\$13.96	\$1,926.48	.81	171.24	\$770.59	\$770.59
6505011561775	432	\$4.45	\$1,922.40	2.53	170.88	\$768.96	\$768.96
6505002213393	86	\$22.13	\$1,903.18	.51	169.17	\$761.27	\$761.27
6505010257416	96	\$19.43	\$1,865.28	.58	165.80	\$746.11	\$746.11
6505011354251	112	\$16.59	\$1,858.08	.68	165.16	\$743.23	\$743.23
6505011908688	36	\$21.06	\$1,811.16	.53	160.99	\$724.46	\$724.46
6505011544486	66	\$23.71	\$1,564.86	.47	139.10	\$625.94	\$625.94
6505010842027	68	\$21.91	\$1,489.88	.51	132.43	\$595.95	\$595.95
6505010498881	324	\$4.57	\$1,480.68	2.46	131.62	\$592.27	\$592.27
6505011651483	140	\$10.46	\$1,467.20	1.07	130.42	\$586.88	\$586.88
6505011065973	186	\$7.88	\$1,465.68	1.43	130.28	\$586.27	\$586.27
6505010836613	216	\$6.65	\$1,436.40	1.69	127.68	\$574.56	\$574.56
6505012036240	42	\$33.61	\$1,411.62	.33	125.48	\$564.65	\$564.65

KEY:

NSN: National Stock Number.
QTY: Quantity (Total quantity ordered for that line in FY87).
UP: Unit Price.
EP: Extended Price.
EPP: Economic Part Period.
ORDERS: Number of Orders in the Year (If EPP quantity is ordered).
HC: Holding Cost.
OC: Order Cost.

APPENDIX H

SAMPLE OUTPUT WITH RESULTS OF
DAYS OF SUPPLY COMPUTATIONS

NSN	DST	QTY	TO	UP	EP	AOST	DOS RO	HC	OC
6505011607702	145	564	17	\$37.71	\$21,268.44	8.53	59.54	\$10,776.47	\$54.00
6505011456757	185	37	16	\$502.40	\$18,588.80	11.56	4.21	\$10,150.18	\$54.00
6505011197848	169	616	15	\$27.61	\$17,007.76	11.27	69.64	\$9,229.86	\$54.00
6505011464174	146	364	13	\$32.17	\$11,709.88	11.23	41.12	\$6,349.25	\$54.00
6505009010043	128	121	15	\$93.04	\$11,257.84	8.53	12.77	\$5,704.79	\$54.00
6505010503547	145	348	14	\$29.46	\$10,252.08	10.36	38.48	\$5,441.03	\$54.00
6505011357373	124	336	12	\$27.73	\$9,317.28	10.33	37.13	\$4,941.99	\$54.00
6505012208416	96	252	10	\$35.79	\$9,019.08	9.60	27.34	\$4,696.84	\$54.00
6505001050372	35	276	5	\$28.26	\$7,799.76	7.00	27.98	\$3,795.17	\$54.00
6505012149062	115	304	13	\$24.95	\$7,634.70	8.85	32.57	\$3,900.21	\$54.00
6505010723413	115	134	13	\$52.35	\$7,014.90	8.85	14.26	\$3,583.59	\$54.00
6505011263842	118	288	9	\$22.23	\$6,402.24	13.11	34.02	\$3,629.69	\$54.00
6505010396321	152	126	15	\$50.10	\$6,312.60	10.13	13.85	\$3,331.67	\$54.00
6505010906797	101	564	13	\$11.19	\$6,311.16	7.77	58.36	\$3,134.70	\$54.00
6505010402278	110	68	11	\$85.40	\$5,807.20	10.00	7.45	\$3,054.75	\$54.00
6505011403199	131	311	20	\$17.87	\$5,557.57	6.55	31.14	\$2,671.29	\$54.00
6505010396320	134	154	15	\$36.01	\$5,545.54	8.93	16.43	\$2,839.32	\$54.00
6505009316646	148	38	13	\$120.96	\$4,596.48	11.38	4.31	\$2,501.57	\$54.00
6505010919624	94	252	12	\$16.27	\$4,100.04	7.83	26.12	\$2,039.91	\$54.00
6505011419463	142	660	15	\$5.86	\$3,867.60	9.47	71.36	\$2,007.34	\$54.00
6505010715559	69	92	9	\$41.89	\$3,853.88	7.67	9.49	\$1,908.99	\$54.00
6505008901355	115	115	12	\$29.77	\$3,423.55	9.58	12.47	\$1,782.12	\$54.00
6505010375607	205	386	17	\$8.86	\$3,419.96	12.06	44.48	\$1,891.59	\$54.00
6505010628010	68	92	7	\$36.97	\$3,401.24	9.71	10.01	\$1,776.37	\$54.00
6505011604995	173	168	7	\$19.99	\$3,358.32	24.71	25.18	\$2,416.41	\$54.00
6505010825321	90	96	11	\$33.89	\$3,253.44	8.18	10.04	\$1,633.61	\$54.00
6505011230984	126	108	13	\$29.23	\$3,156.84	9.69	11.74	\$1,647.81	\$54.00
6505001656545	123	80	11	\$36.17	\$2,893.60	11.18	9.03	\$1,567.08	\$54.00
6505011451272	22	57	4	\$48.88	\$2,786.16	5.50	5.54	\$1,300.72	\$54.00
6505010701493	73	47	9	\$58.82	\$2,764.54	8.11	4.91	\$1,385.55	\$54.00
6505011169245	94	556	14	\$4.72	\$2,624.32	6.71	55.93	\$1,267.07	\$54.00
6505010034119	86	96	8	\$25.80	\$2,476.80	10.75	10.72	\$1,327.29	\$54.00
6505001335443	80	420	12	\$5.73	\$2,406.60	6.67	42.19	\$1,160.44	\$54.00
6505011858848	92	12	10	\$194.34	\$2,332.08	9.30	1.29	\$1,205.27	\$54.00
6505000519050	151	119	17	\$19.10	\$2,272.90	8.88	12.68	\$1,162.20	\$54.00
6505000035112	127	68	11	\$31.85	\$2,165.80	11.55	7.74	\$1,185.29	\$54.00
6505011966212	104	126	12	\$16.37	\$2,062.62	8.67	13.35	\$1,048.83	\$54.00
6505011742384	100	238	11	\$8.66	\$2,061.08	9.09	25.49	\$1,059.54	\$54.00
6505012045417	93	110	10	\$18.55	\$2,040.50	9.30	11.84	\$1,054.58	\$54.00
6505011385646	71	96	9	\$20.43	\$2,002.14	7.89	10.17	\$997.60	\$54.00
6505011374627	70	102	10	\$19.56	\$1,995.12	7.00	10.34	\$970.78	\$54.00
6505010301647	171	240	14	\$8.16	\$1,958.40	12.21	27.76	\$1,087.20	\$54.00
6515010891069	48	104	7	\$18.72	\$1,946.88	6.86	10.50	\$943.65	\$54.00
6505011481992	108	13	5	\$148.90	\$1,935.70	21.60	1.84	\$1,313.52	\$54.00
6505010830900	117	138	10	\$13.96	\$1,926.48	11.70	15.77	\$1,056.45	\$54.00
6505011541775	142	432	10	\$4.45	\$1,922.40	14.20	52.31	\$1,117.41	\$54.00
6505002213397	139	84	13	\$22.13	\$1,903.18	10.69	9.59	\$1,018.45	\$54.00
6505010257416	90	96	9	\$19.43	\$1,865.28	10.00	10.52	\$981.19	\$54.00
6505011354251	65	112	8	\$16.59	\$1,858.08	8.12	11.70	\$931.59	\$54.00
6505011908688	92	86	10	\$21.06	\$1,811.16	9.20	9.24	\$933.67	\$54.00
6505011544486	73	66	5	\$23.71	\$1,564.86	14.60	8.06	\$917.82	\$54.00
6505010942027	105	68	10	\$21.91	\$1,489.88	10.50	7.55	\$793.51	\$54.00
6505010498881	74	324	10	\$4.57	\$1,480.68	7.40	33.20	\$728.25	\$54.00
6505011651483	80	140	10	\$10.48	\$1,467.20	8.00	14.58	\$733.20	\$54.00
6505011065973	106	186	13	\$7.88	\$1,465.68	6.15	19.44	\$735.40	\$54.00
6505010836613	113	216	12	\$6.65	\$1,436.40	9.42	23.33	\$744.57	\$54.00
6505012036240	52	42	7	\$33.61	\$1,411.62	7.43	4.31	\$694.82	\$54.00

KEY:

NSN: National Stock Number.
DST: Order-Ship Time.
QTY: Quantity (Total quantity ordered for that line in FY87).
TO: Times Ordered (Total number of orders for that line in FY87).
UP: Unit Price.
EP: Extended Price.
AOST: Average Order-Ship Time.
DOS RO: Days of Supply Requisitioning Objective.
HC: Holding Cost.
OC: Order Cost.

APPENDIX I

ZENITH COMPUTER CONTRACT PRICE LIST

<u>ITEM</u>	<u>PRICE</u>
Basic Computer System	\$1,103.00
Intermediate Computer Systeem	\$1,534.00
Advanced Computer System	\$1,658.00
2MB Memory Expansion	\$240.00
Dot Matrix/Letter Quality Printer	\$528.00
RGB Color Monitor	\$302.00
Surge Suppressor	\$30.00
Dial-up Modem	\$158.00
Modem Cable	\$5.00
External Tape Backup Unit	\$478.00
80287 Math Coprocessor	\$143.00
Asynchronous Card	\$27.00
Annual Maintenance	\$292.00
Annual Supplies	\$100.00
Enable Integrated Software	\$193.00

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